# communications

## OPERATING and SERVICE INSTRUCTIONS

HT-32
MARK I

the hallicrafters co.
MANUFACTURERS OF ELECTRONIC EQUIPMENT, CHICAGO 24, U. S. A.

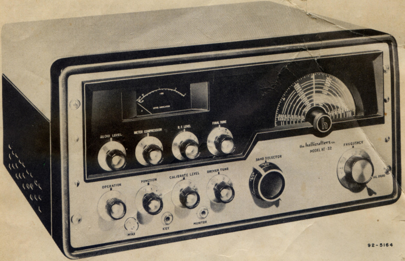


Figure 1. Hallicrafters Model HT-32 Transmitter/Exciter

# SECTION I
# GENERAL

1-1. The Hallicrafters Model HT-32 Transmitter/Exciter is the ultimate in design of self-contained transmitting equipment. This twenty-tube precision built transmitter/exciter is capable of SSB (single sideband with suppressed carrier), DSB, and CW transmission in the 80, 40, 20, 15, 11, and 10 meter bands. This unit can represent the complete transmitting complement of any amateur station. The only requirements for immediate "on the air" operation are a 50-ohm terminated antenna system, key or microphone, and AC power source.

1-2. This unit may be utilized as a complete self-contained transmitter, or as an exciter for a linear power amplifier such as the Hallicrafter Model HT-33. If other linear amplifiers are employed, they should be capable of supplying a 50-ohm termination to the driver output to utilize the full capabilities of the HT-32. Maximum power output ratings of the HT-32 are:

SSB, 70-100 watts P.E.P. (peak envelope power);
CW 70-100 watts; and DSB 17-25 watts (carrier power).

Prominent features of the HT-32 Transmitter/Exciter are:

- New high frequency crystal sideband filter - rejection 50 db. or more.
- Bridged-tee sideband modulator.
- C.T.O. direct reading in kilocycles to less than 300 cycles from reference point.
- 144 watts plate input (P.E.P. two-tone).
- Six band output (80, 40, 20, 15, 11-10 meters).
- Unwanted sideband down 50 db. or more.
- Distortion products down 30 db. or more.
- Carrier suppression down 50 db. or more.

1-3. T.V.I. (Television Interference) SUPPRESSION.

The HT-32 has been designed and constructed to suppress spurious radiations that may cause television interference. The TVI problem was given full consideration in the design of every circuit as well as in the selection and layout of parts. Adequate filtering has been provided for control circuits and AC power lines. Components were specifically selected to avoid undesired resonances and arranged to prevent parasitic oscillation.

Another important T.V.I. proofing feature is employed in the output coupling circuit of the final amplifier. The tuned output circuit is a pi network that has inherently excellent harmonic suppression ability. The unique design of this network is such that the conventional loading control is unnecessary and only the final tank tuning need be adjusted. The pi network is connected to a coaxial connector and permits the use of any antenna system having a transmission line impedance of 50 ohms. In addition to these factory installed precautions, a 50-ohm low pass TVI filter, which connects between the antenna and the transmitter/exciter output, is available as an accessory. This unit may be obtained from your Hallicrafters dealer under part number 1X2621.

The Model HT-32 Transmitter/Exciter, as received from the factory, has had every advantage of Hallicrafters advanced engineering to minimize television interference. There are, however, some types of TVI that cannot be prevented within the transmitter itself. For example, when a television receiver is located in the immediate vicinity of the transmitter/exciter it is entirely possible that a fundamental signal will reach the input grid of the receiver in sufficient strength to cause a slight amount of interference. In such cases, it will be necessary to install a filter or trap at the television receiver to attenuate the transmitter's fundamental signal. If the interfering signal does not enter the television receiver through the antenna, special shielding or filters on the TV receiver may be necessary. For a more complete discussion of measures that may be used to handle these special television interference problems, refer to the ARRL HANDBOOK.

# SECTION II
# INSTALLATION

2-1. UNPACKING.

After unpacking the HT-32 Transmitter/Exciter, examine it closely for any possible damage which may have occurred during transit. Should any sign of damage be apparent, file a claim immediately with the carrier stating the extent of damage. Carefully check all shipping labels and tags for any special instructions before removing or destroying them.

2-2. LOCATION.

Although the Model HT-32 Transmitter/Exciter is provided with a built-in power driven fan for cooling purposes, avoid excessively warm locations such as those near radiators and heating vents. The unit should be placed in a location that provides adequate space around it, permitting free circulation of air through the cabinet openings.

2-3. POWER SOURCE.

The HT-32 Transmitter/Exciter is designed to operate on 105 to 125 volt, 50-60 cycle AC current, power consumption is 375 watts.

> IMPORTANT: If in doubt about your power source, contact your local power company prior to inserting the power cord into an AC power outlet. Plugging the power cord into the wrong power source can cause extensive damage to the unit, requiring costly repairs.

2-4. REAR CHASSIS CONNECTIONS (See Figure 2)

Sockets are provided on the rear of the HT-32 Transmitter/Exciter for the following purposes:

2-4-1. R. F. OUTPUT.

This is a coaxial connector which connects the Transmitter/Exciter to the antenna system or a linear amplifier. The connecting cable (52 ohm coax.) should be fitted with an Amphenol type 83-1SP connector or its equivalent. The selection of the type of antenna and coupling will depend upon the frequencies used and the purpose of operation. Refer to the ARRL ANTENNA HANDBOOK for detailed information concerning transmitting antennas.

2-4-2. CONTROL OUTLET

An eleven pin socket is provided at the rear of the chassis to connect the HT-32 Transmitter/Exciter into your control system. The mating connector for this socket is an Amphenol 86-PM11. The instructions which follow may be modified to suit your particular needs.

2-4-3. KEY (Pins 8 and 9). For CW operation, the hand key or "bug" is connected to pins 8 and 9 of the control outlet. Pin 9 is internally grounded in the unit. When the key is up, cutoff bias is maintained at the third mixer and driver stages. Closing the key removes the cutoff bias providing signal excitation to the succeeding RF amplifier stages. A key jack is also provided at the front panel for those who prefer a panel connection for the key.

2-4-4. ANTENNA RELAY (Pins 2, 3 and 4). An external antenna change-over relay may be employed by utilizing pins 2, 3, and 4 on the control outlet. These pins are connected internally to insulated contacts on the VOX RELAY of the Transmitter/Exciter. Figure 3 illustrates typical connections of an external change-over relay to the control outlet. During periods of transmission the VOX relay connects pins 2 and 3 enabling the external power source to activate the external antenna change-over relay. For external applications where an open circuit is required when transmitting, pins 3 and 4 may be used. The voltage required of the external power source is dependent upon the type change-over relay used. A coaxial type relay for 50-ohm transmission line impedance is recommended. Where pins 2, 3, and 4 are used to switch external equipment loads, the load current should be limited to one ampere.

2-4-5. RECEIVER AUDIO (Pins 9 and 10) AND SPEAKER (Pins 1 and 11).

Connect the audio output of the station's receiver directly to pins 9 and 10 of the control outlet. (Pin 9 is ground or chassis side.) Connect a 2 watt resistor across the receiver audio output to maintain a load at all times. The receiver speaker is connected directly to pins 1 and 11. (Pin 1 is ground side.) Connecting the receiver and speaker in this manner prevents the actuating of the transmitter/exciter VOX circuit by incoming audio signals from the receiver and also disconnects the receiver output to the speaker when the transmitter/exciter is on the air. Use an 18-ohm 2 watt resistor for 3 to 8 ohm voice coil impedances or 1500 ohm 2 watt resistor for 500-600 ohm outputs.

2-4-6. BIAS (Pins 5, 6, and 7). Cutoff bias (-100V) or

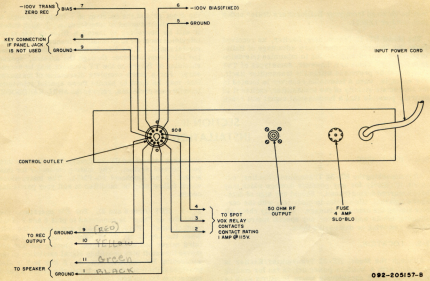

-100V TRANS ZERO REC
BIAS
7
6
-100V BIAS (FIXED)
5
GROUND
KEY CONNECTION IF PANEL JACK IS NOT USED
8
9
GROUND
INPUT POWER CORD
SO8
CONTROL OUTLET
50 OHM RF OUTPUT
FUSE 4 AMP SLO-BLO
4
3
2
TO SPDT VOX RELAY CONTACTS CONTACT RATING 1 AMP @ 115V.
TO REC OUTPUT
GROUND
9
(RED)
10
YELLOW
TO SPEAKER
11
Green
GROUND
1
BLACK
092-205157-B

Figure 2. Rear Chassis Connections

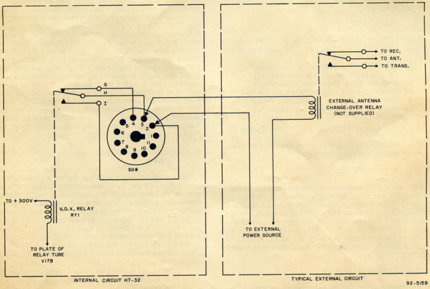

G
H
I
4
3
5
2
6
1
7
11
8
9
10
SO8
TO +300V
V.O.X. RELAY RY1
TO PLATE OF RELAY TUBE V17B
TO EXTERNAL POWER SOURCE
TO REC.
TO ANT.
TO TRANS.
EXTERNAL ANTENNA CHANGE-OVER RELAY (NOT SUPPLIED)
INTERNAL CIRCUIT HT-32
TYPICAL EXTERNAL CIRCUIT
92-5159

Figure 3. Control Outlet Relay Connections

control bias is available at either pin 6 or pin 7 with pin 5 used as the return or ground connection. At pin 6 the bias is fixed at -100V regardless of the mode of operation of the transmitter. At pin 7 the voltage is zero at standby or receive and -100V during transmission, an external relay may be used with the fixed bias provided at pin 6. Note that the bias source is high impedance and not intended as a "hard" bias source for fixed bias applications in power amplifiers.

# SECTION III

# FUNCTION OF OPERATING CONTROLS

### 3-1. FUNCTION

The FUNCTION control is a four position rotary switch which selects CW, DSB, UPPER or LOWER SIDEBAND type of transmission as desired by the operator. An analysis of the FUNCTION switch operation is given in paragraphs 4-4, 4-5, and 4-6.

### 3-2. OPERATION

This control is a five position rotary switch which turns the power to the transmitter on or off, places the transmitter in calibrate operation or selects the mode of operation (VOX or MOX). The "CALIBRATE" position is used in conjunction with the CALIBRATE LEVEL control. (See paragraph 3-11.)

CAUTION

> When turning off transmitter, stop momentarily in the "STANDBY" position, before turning switch to "OFF" position.

The "MOX" position energizes the transmitter control relay to the transmit position. This position of the OPERATION switch is used when manual control of transmission is desired. Return the switch to the "STANDBY" position during receiving periods.

In the "CALIBRATE" position, the transmitter/exciter control relay (VOX RELAY) is de-energized, permitting normal receiving operation with an antenna change-over relay (if used) in the receiver position. With the receiver in operation the transmitter signal can now be monitored and the signal level in the receiver controlled with the CALIBRATE LEVEL control. See paragraph 3-11.

In the "VOX" position, the transmitter control relay is operated by voice energy from the microphone. The relay tube is biased to cut-off and will not energize the VOX RELAY until signal excitation is received from the audio amplifier and vox amplifier stages.

### 3-3. DRIVER TUNING.

This control is a variable capacitor in the VFO mixer plate, and driver plate circuits, and will resonate the circuits to any frequency in the 80, 40, 20, 15 and 10-11 meter bands.

### 3-4. BAND SELECTOR.

The BAND SELECTOR control is a five position rotary switch which selects the proper combination of tuned circuits and stages for the desired frequency band. It also selects the correct crystal oscillator (4.05 or 13.95 MC) to produce the desired sideband when the FUNCTION switch is set at either "UPPER" or "LOWER SIDEBAND"

### 3-5. FINAL TUNING

This control is a variable capacitor in the final amplifier tank circuit and will resonate the circuit to the operating frequency of the selected band. The dial calibrations permit presetting the control roughly during tune up.

### 3-6. FREQUENCY

The FREQUENCY control is a variable capacitor which sets the VFO frequency. The VFO covers the frequency range 5,000 kilocycles to 5,500 kilocycles. With mixing circuits, the VFO will set the transmitter/exciter to the desired operating frequency as indicated on the dial in any of the five bands. Each minor marker on the skirt of the FREQUENCY control is equivalent to approximately 200 cycles on all bands.

### 3-7. DIAL DRAG.

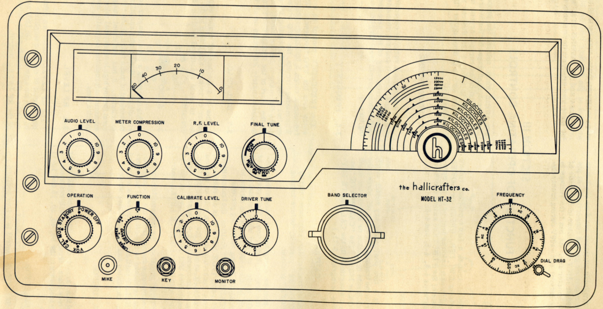
This is a mechanical brake which can be adjusted either to lock or apply drag to the FREQUENCY control to avoid accidental rotation of the control during operation.

### 3-8. AUDIO LEVEL.

This control is a potentiometer connected in the grid circuit of the third audio amplifier stage and adjusts the amount of audio drive to the "bridged-T" balanced modulator. It has sufficient range to permit adjustment for any high level crystal microphone or low level dynamic microphone normally used for voice communications.

### 3-9. RF LEVEL.

The RF LEVEL control is a potentiometer in the grid bias circuit of the 9 mc amplifier tube to adjust the gain of the 9 mc amplifier. On DSB and CW, the amount of carrier in the output signal is determined by the setting of the RF LEVEL control.


AUDIO LEVEL
METER COMPRESSION
R.F. LEVEL
FINAL TUNE
OPERATION
POWER OFF
STANDBY
MOX
CAL
VOX
FUNCTION
CALIBRATE LEVEL
DRIVER TUNE
MIKE
KEY
MONITOR
BAND SELECTOR
the hallicrafters co.
MODEL HT-32
FREQUENCY
DIAL DRAG
KILOCYCLES
KILOCYCLES
KILOCYCLES
KILOCYCLES
KILOCYCLES
KILOCYCLES
KC
0
10
20
30
40
60

92-5158-B

Figure 4. Front Panel

### 3-10. METER COMPRESSION.

This is a meter sensitivity control which permits the operator to set the meter at maximum deflection (0 db) for desired output level (between approximately 1/4 power and full power) when establishing proper drive levels in the transmitter/exciter. (See LEVEL INDICATOR METER, paragraph 3-13.)

### 3-11. CALIBRATE LEVEL.

The CALIBRATE LEVEL control provides a low level adjustment of the transmitter output for SSB, DSB, or CW operation when the OPERATION control is set at CALIBRATE. The CALIBRATE LEVEL control is normally set to provide the desired signal level in the station receiver for monitoring purposes and need not be changed except possibly when changing bands. For CW or DSB work a carrier signal is obtained for "zero beat" frequency setting. On SSB a sideband signal is obtained when talking into microphone to "talk onto frequency". If the zero beat method is preferring by the sideband operator, the FUNCTION control is switched to DSB to obtain a carrier for calibration purposes then switched back to the desired sideband before going on the air. Note that on DSB or CW the preset RF LEVEL setting is not to be disturbed when calibrating.

### 3-12. MONITOR.

Inserting headphones into this jack permits voice controlled headphone reception in the VOX mode of operation. Inserting the plug of a headset in the jack will automatically cut off the receiver speaker when it is connected as instructed in paragraph 2-4-5.

### 3-13. LEVEL INDICATOR METER.

The LEVEL INDICATOR METER indicates the output of the transmitter/exciter in db below "0" db reference, enabling the adjustment of the transmitter/exciter for correct output (drive level required for a linear amplifier or approximate rated output for "barefoot" operation). Tuning of the transmitter has been simplified by the design of the front panel meter circuit. The meter scale is compressed to enable low-level signals to produce a usable indication, yet strong signals do not drive the meter pointer off scale. This feature gives the meter a wide usable dynamic range which is not possible to obtain with a linear scale. The desired amount of compression may be obtained by adjusting the METER COMPRESSION control on the front panel. The output reading on the LEVEL INDICATOR METER can be shifted to read full scale ("0" db) down to approximately 1/4 of full power and any level below this reference can easily be read on the meter. A log of METER COMPRESSION control settings, for normal output into loads of controlled and reproducible characteristics, will aid in re-establishing proper drive levels and determining the proper operation of the unit. The log should be recorded at various frequencies and modes of operation.

To monitor carrier suppression for SSB operation set the METER COMPRESSION control to read zero db reference on the meter at the maximum sideband output (single tone) and read carrier level directly when the audio excitation is removed. Note that the MOX mode of operation must be used for this test since in VOX operation the transmitter is disabled between voice controlled transmissions by the operation of the VOX relay.

## SECTION IV
## TUNING PROCEDURE

### 4-1. GENERAL.

The tuning procedure for the Model HT-32 Transmitter/Exciter has been simplified by design as much as possible to permit rapid adjustment by the operator. This does not mean, however, that a transmitter, commercial or home-built, may be operated successfully when only roughly adjusted. A clean signal from any transmitter requires good operator technique.

Two mis-tuning conditions on the HT-32 Transmitter/Exciter are possible, neither of which can be accidentally used on the air. These undesired signals are visible on the output meter due to the extreme range of levels handled by the metering circuit and are 60 db or more below fundamental output when the transmitter is correctly tuned up.

1. On the 15-meter band the undesired signal will appear when the DRIVER TUNE control is set outside its normal tuning range, approximately 0 to 1 division on the dial. Note that its level cannot be increased on AM or CW with the RF LEVEL control or driver by speech input on SSB, hence may be identified in this manner.
2. On the 10-meter band the undesired signal will appear when the DRIVER TUNE control is set outside its normal tuning range. For example when tuning the 29 mc to 29.5 mc segment of the 10-meter band, the DRIVER TUNE control will normally tune up around 4 on the dial while the unwanted signal tunes up at around 2 divisions on the dial. Here again it is identified by the fact that its level cannot be increased on AM or CW with the RF LEVEL control or driver on SSB with speech input.

### 4-2. LOAD.

Connect a 50-ohm non-reactive load to the R.F. OUTPUT connector on the Transmitter/exciter. This impedance may be an antenna or a properly adjusted linear amplifier. A 50-ohm non-reactive load of at least 100 watts dissipation capabilities is required to handle the full power output.

### 4-3. INITIAL CONTROL SETTINGS.

Set the front panel controls to their starting positions as outlined below.

| | |
|---|---|
| OPERATION | STANDBY (Power on) |
| FUNCTION | DSB |
| AUDIO LEVEL | 0 |
| R.F. LEVEL | 0 |

| | |
|---|---|
| METER COMPRESSION | 5 |
| CALIBRATE LEVEL | 0 |
| DRIVER TUNING | CENTER OF ROTATION |
| FINAL TUNING | DESIRED BAND SEGMENT |
| BAND SELECTOR | DESIRED BAND |
| FREQUENCY | DESIRED FREQUENCY |

## 4-4. CW TUNING.

The tuning procedure for CW operation will be presented first since AM (DSB) and SSB tuning procedures are modifications of that required for CW operation.

The tuning procedure for CW operation is as follows:

1. Set the OPERATION switch at MOX, FUNCTION switch at DSB.
2. Tune the driver and final amplifier stages, with the DRIVER TUNE and FINAL TUNE controls, for maximum meter deflection. Advance the RF LEVEL control slightly if necessary to obtain reasonable meter readings for tune up. Since these tuned circuits, as in any transmitter, effect transmitter performance, ALWAYS TUNE FOR MAXIMUM OUTPUT.
3. Set FUNCTION switch at CW and close key.
4. Advance the RF LEVEL control slowly while observing the output meter. When feeding a dummy or an antenna load set the control at a point where further rotation does not cause an appreciable increase in the meter reading. This is saturation output, operate slightly below this level for CW. When driving a final amplifier stage with the HT-32 Transmitter/Exciter, advance the RF LEVEL control until required excitation is obtained for the amplifier. In either case do not operate beyond the saturation level.
5. A convenient reference for this operating level may be obtained by setting the METER COMPRESSION control so that the output meter reads 0 db.
6. Recheck the driver and final tuning by reducing the carrier level by about 5 or 10 db on the output meter with the RF LEVEL control and touching up the DRIVER TUNE and FINAL TUNE controls for maximum output. Reset the RF LEVEL control for maximum output just below the saturation point as outlined above.
7. Open the key. The output should drop to zero.
8. When operating CW with separate transmitting and receiving antennas the OPERATION switch may be left in the MOX position since the transmitter is completely disabled when the key is open. If the transmitter and receiver share the same antenna, and the antenna change-over relay is operated by the relay in the transmitter, then the OPERATION switch must be set at STANDBY to place the receiver in operation. Refer to the use of the CAL position of the OPERATION switch and the CALIBRATE LEVEL control for "zeroing-in" on the receiver frequency. See paragraph 3-11.

## 4-5. SSB TUNING.

The tuning procedure for SSB operation is as follows:

1. Set the OPERATION switch at MOX, FUNCTION switch at DSB (Audio level zero).
2. Tune the driver and final amplifier stages as described for CW tune up.
3. Set the FUNCTION switch to UPPER or LOWER sideband as desired. If the output meter was referenced at 0 db for maximum output with the COMPRESSION control, the meter will now indicate the carrier suppression directly in db below maximum output.
4. Set the OPERATION switch at MOX (manual operation).
5. While monitoring the transmitter output, proceed with SSB transmission, setting the AUDIO LEVEL control for the required audio gain which does not produce peak flattening or overload distortion of the output signal. Note that the output meter damping factor prevents the meter from indicating 0 db reference on voice peaks. The meter will swing roughly 2/3 scale with voice excitation.
6. If manual operation is desired on SSB, switch the OPERATION control between MOX and STANDBY. For voice control operation with the receiver and transmitter interconnected, set the OPERATION control at VOX. To "zero-in" on frequency see paragraph 3-11 regarding the calibration procedure. For information on the use of the VOX, DELAY, and ANTI-TRIP controls see paragraphs 4-8, and 4-9.

## 4-6. AM (DSB)TUNING.

The tuning procedure for AM operation is as follows:

1. Set the OPERATION switch at MOX, FUNCTION switch at DSB (Audio level zero).
2. Tune the driver and final amplifier stages as described for CW tune up.
3. When feeding a dummy or antenna load advance the RF LEVEL control to the saturated output level and reference 0 db on the output meter with the METER COMPRESSION control as described for CW tune up. When driving a linear power amplifier with the HT-32 advance the RF LEVEL control until maximum linear power output is obtained from the final amplifier stage before setting the reference level on the output meter.
4. With the RF LEVEL control, reduce the carrier level 6 db as read on the output meter. This sets the maximum carrier level that the linear amplifiers in the HT-32 Transmitter/Exciter or following linear power amplifier can handle and provide 100% modulation capabilities. This carrier reference level can be established more precisely if an oscilloscope and audio oscillator are used to set up and monitor the output signal. Note that if the carrier level is set too high, peak amplitudes are flattened before 100% modulation occurs. If the carrier level is set too low the maxi-

mum power output capabilities are not attained at 100% modulation.

5. While monitoring the transmitter output, proceed with AM transmission, setting the AUDIO LEVEL control for the required audio gain which does not produce peak flattening or over modulation distortion of the output signal. Note that the output meter damping factor permits a rough operational check on over modulation. The output meter will drop about 1 to 2 db in level when the percentage of modulation with voice excitation runs close to 100%.

6. If manual operation is desired on AM, switch the OPERATION control between MOX and STANDBY. For voice control operation with the receiver and transmitter interconnected, set the OPERATION control at VOX.

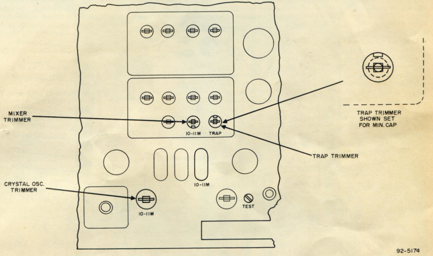


Figure 5. 10-11 Meter Band Adjustments

4-7. SEGMENT ALIGNMENT FOR 10-11M BAND.

The HT-32 Transmitter/Exciter is set up at the factory to provide transmission in the 28. 5 to 29. 0 MC segment of the 10M band.

The 11M band or other 0. 5 MC segments of 10M band are set up as follows: (Refer to Figure 5 for locations of the various adjustments referred to in the following procedure.)

1. Tune up on CW and determine the saturation level setting of the RF LEVEL control. Record this setting for future reference in step 5.

2. Remove the 32. 5 MC crystal and insert desired crystal. *

| BAND | NOMINAL FREQ. | OUTPUT FREQ. | PART NUMBER |
|---|---|---|---|
| 11M | *30. 9Mc | 26. 96 - 27. 23mc | 19B1962 |
| 10M | *32. 0Mc | 28. 0 - 28. 5 mc | 19B1963 |
| 10M | 32. 5Mc | 28. 5 - 29. 0 mc | 19B1964 |
| 10M | *33. 0Mc | 29. 0 - 29. 5 mc | 19B1965 |
| 10M | *33. 5Mc | 29. 5 - 30. 0 mc | 19B1966 |

*NOTE: These crystals are available but not supplied with the transmitter.

3. Connect electronic voltmeter or similar high impedance DC voltmeter (0-10V) to crystal oscillator test point, and adjust crystal oscillator trimmer for approximately half of the voltage obtained at the maximum voltage setting of the trimmer. Set the trimmer on the gentle slope side of resonance.

4. Set TRAP TRIMMER for minimum capacity and adjust 11-10M mixer trimmer for maximum output. Increase RF LEVEL control setting if necessary to pick up an output meter reading as the mixer is tuned to resonance. Back off the RF LEVEL as resonance is obtained with mixer trimmer and DRIVER TUNE control.

5. Touch up FINAL TUNE control then adjust crystal oscillator trimmer and RF LEVEL control until the saturation output again occurs at the RF LEVEL setting originally obtained for the previous crystal used. See step 1.

6. Trap adjustment - This adjustment is optional as far as spurious output in the 10M band is concerned since its level is less than 60 db below fundamental only when the transmitter is mistuned. To locate

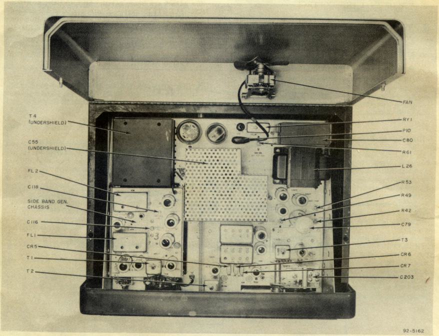


Figure 6. Top Chassis View

the spurious signal, turn the RF LEVEL control to zero or switch to upper or lower sideband position of the operation switch, and tune the DRIVER TUNE and FINAL TUNE for maximum output. Adjust the 10-11M trap trimmer for minimum output meter reading.

7. Re-check the 10-11M mixer trimmer setting by again tuning up on the desired frequency and peaking the trimmer, since the trap adjustment will affect the original mixer setting slightly.

## 4-8. USE OF VOX AND DELAY CONTROLS.

The VOX and DELAY controls are located on the top of the transmitter/exciter chassis as illustrated in Figure 6. Both controls are utilized in conjunction with VOX operation and are adjusted to provide control of the transmitter and station receiver.

1. The VOX control is an audio sensitivity control which determines the audio level which will trip (energize) the VOX RELAY, placing the transmitter/exciter "on the air". This control should be adjusted with the microphone at the normal speaking distance from the mouth. Advance the VOX control to a setting slightly above that which will "trip" the VOX RELAY. Excessive sensitivity will have the undesirable result of background noise "tripping" the VOX RELAY and placing the transmitter/exciter on the air. Note that the VOX sensitivity control and the AUDIO LEVEL control for the microphone are separate level adjustments, hence for example, backing off the AUDIO LEVEL control will not reduce the VOX sensitivity.

2. The DELAY control is in the grid circuit of the relay tube and determines the time lag in de-energizing the VOX RELAY when audio excitation is removed from the audio amplifier and VOX amplifier stages. This control should be advanced while speaking into the microphone and set at a position in which the time lapse between words will not de-energize the VOX RELAY. This adjustment will eliminate the constant keying of the transmitter/exciter at the beginning of each word when speaking. There is a slight interaction between the VOX and DELAY circuits, consequently, a slight re-adjustment of both controls may be necessary to obtain desired results.

## 4-9. USE OF ANTI-TRIP CONTROL.

This control is located on top of the transmitter/exciter chassis (Figure 6) and is used in conjunction with VOX operation. When the station receiver and speaker are connected for VOX operation (paragraph 2-4-5), the speaker ANTI-TRIP control is advanced to a setting where the audio signal picked up by the microphone from the receiver's speaker will not energize the VOX RELAY. This feature prevents the re-transmitting of the incoming audio signals from your station receiver. Note that an excessive speaker gain setting is capable of disabling the VOX relay completely, hence the minimum required gain should be used for best results

## 4-10. BIAS ADJ. CONTROL.

This control has been factory set for -49V as measured at the adjacent TEST terminal.

The control is located to the rear of the chassis and slightly to the right of center. (See Figure 6.)

An occasional check with an accurate, high resistance voltmeter will insure maximum tube life since the 6146 final amplifier tubes are operated close to rated plate dissipation for optimum performance.

To adjust the bias, set the OPERATION switch at MOX, FUNCTION switch at either sideband (zero signal) and adjust for -49V ±1V with the voltmeter connected between the test point terminal (-) and chassis (+). Note polarity since this is a bias voltage.

## 4-11. MODEL HT-32 WITH LINEAR POWER AMPLIFIER.

When the Model HT-32 Transmitter/Exciter is used to drive a linear amplifier, swamping or padding between the units may be required for optimum performance.

The degree of swamping or padding will depend upon the driving power required by the linear amplifier. High powered grounded grid or triode amplifiers generally will require little or no swamping since the driving power will be essentially equal to the power output capabilities of the HT-32. Linear power amplifiers using tetrodes or pentodes on the other hand generally require considerably less than the peak power output available from the HT-32.

In general the swamping between units should "soak" up the unused driving power so that the driver unit (HT-32) is running reasonably close to its peak power output and terminated in a 50-ohm load. This condition

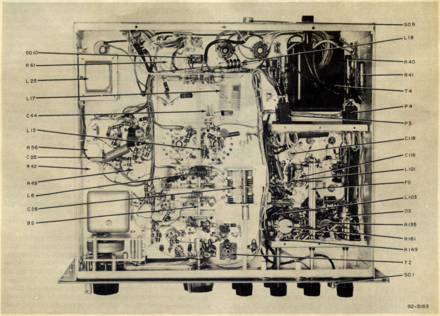


Figure 7. Bottom Chassis View

will retain the carrier suppression of the HT-32 for the overall system as well as hum and noise ratio which are all related to the peak envelope power output.

For example - Should the linear power amplifier require 40 to 50 watts of drive then a 3 db T pad designed for 50-ohm terminations would fully load the HT-32 while still transferring the required driving power to the final amplifier grids.

4-12. SERVICE OR OPERATING QUESTIONS.

For further information regarding operation or servicing of your Model HT-32 Transmitter/Exciter, write to:

General Service Manager
The Hallicrafters Co.
4401 West Fifth Ave.
Chicago 24, Illinois

Be sure to include the model, serial, mark number, and date purchased.

Make no service shipments to the factory unless instructed to do so by letter. The Hallicrafters Company will not accept the responsibility for unauthorized shipments.

The Hallicrafters Company reserves the privilege of making revisions in current production of equipment and assumes no obligation to incorporate these revisions in earlier models.

Authorized
hallicrafters
Service Center
communications
equipment

92X1401-C

# SECTION V
# SERVICE DATA

5-1. TECHNICAL SPECIFICATIONS.

| | |
|---|---|
| TUBES | 17 plus 1 voltage regulator and 2 voltage rectifiers |
| POWER SOURCE | 105-125 volts, 50/60 cycles AC |
| POWER OUTPUT: | |
| SSB (PEP) | 70-100 watts |
| CW | 70-100 watts |
| AM (CARRIER) | 17-25 watts |
| AUDIO INPUT | 0.004V rms minimum |
| STABILITY | 0.009 % maximum |
| HUM AND NOISE OUTPUT | At least 40 db below carrier |
| UNWANTED BEAT OUTPUT | At least 55 db below carrier |
| FREQUENCY COVERAGE | 80, 40, 20, 15, 11, and 10 meter bands |
| FREQUENCY SELECTION | Self contained VFO |
| DIMENSIONS | 10-3/8" Height, 16" Deep, 20" Wide |
| SHIPPING WEIGHT | 85-1/4 lbs |

5-2. CHASSIS REMOVAL.

The chassis and front panel assembly are removable as a unit from the cabinet by removing 2 screws at each side of the front panel and the 3 screws on the underside of the cabinet.

5-3. TUBE AND DIAL LAMP REPLACEMENT.

Access to the dial lamps and all tubes may be obtained by raising the top cover of the cabinet.

# SECTION VI
# BASIC OPERATING THEORY

6-1. BASIC OPERATING PRINCIPLES.

The basic operating principles of the Model HT-32 Transmitter/Exciter is explained in the following subparagraphs. Figure 10 is a block diagram of the transmitter/exciter and figure 12 is the schematic diagram. The complete system is first discussed for SSB operation and a brief description of CW and AM operation follows.

6-2. GENERAL DESCRIPTION.

Tube V1A is a 4.95 MC crystal controlled oscillator; its output frequency is ultimately converted to the desired operating frequency by heterodyne action in the succeeding stages. The output of V1A is a 4.95 MC signal which is fed directly to the tank circuit of the bridged-T modulator network. The audio input is impressed across diode modulator V14 which is part of the grounding leg of the bridged-T modulator network. The proper phase relation has been obtained by the CARRIER BALANCE controls.

In SSB operation, (FUNCTION switch in UPPER SB or LOWER SB position), the bridged-T modulator network is placed in a balanced condition and carrier output is at least 50 db below peak envelope power. Under balanced conditions, the output of the bridged-T modulator network consists of the upper and lower sideband of 4.95 mc. A filter system, in the input and output circuits of the sideband filter amplifier stage, V2, suppresses the lower sideband of the modulated 4.95 mc signal. The upper sideband is fed to the 1st mixer, V3, where it is combined with 4.05 mc or 13.95 mc, as selected, from V4. The oscillator frequency used determines whether the upper or lower sideband is transmitted. For example:

1. Upper sideband - the upper sideband of 4.95 mc is mixed (sum) with 4.05 mc to obtain the upper sideband at 9 mc. The inter-stage coupling between 1st mixer, V3; 9 mc amplifier, V5; and 2nd mixer, V7 consists of tuned transformers T1 and T2 which pass only a band of frequencies near 9 mc.

2. Lower sideband - the upper sideband of 4.95 mc is mixed with 13.95 mc to obtain the lower sideband at 9 mc. As in the upper sideband condition, the inter-stage coupling of V3, V5, and V7 pass only the frequencies near 9 mc.

Up to the input stage of 2nd mixer, V7, the operation of the HT-32 Transmitter/Exciter is identical on all bands. The remaining stages "beat" (sum or difference) the selected 9 mc sideband to the desired operating frequency. Frequency multiplication cannot be used since doubling the frequency would double the spacing of the sidebands. This would change the relative frequency of the modulating frequencies when the signal is detected.

### 6-3. 80-METER OPERATION.

The selected sideband (upper or lower) at 9 mc is amplified by 9 mc amplifier, V5, and fed to the 2nd mixer V7. On 80 meters, heterodyne oscillator, V6, has no output and the 2nd mixer, V7, functions as an additional amplifier. At the 3rd mixer, V8, the sideband is mixed (difference) with the output frequency of the VFO, V9. Since the VFO output frequency is tunable from 5.0 to 5.5 mc, the difference output of V8 is the sideband of a frequency between 3.500 to 4.000 mc.

### 6-4. 40 METER OPERATION.

The selected sideband at 9 mc is mixed (difference) with a 21.5 mc output of heterodyne oscillator V6 in 2nd mixer, V7. The output of V7 is a sideband at 12.5 mc which is applied to the 3rd mixer, V8. In this stage, the signal is mixed (difference) with the VFO output (5.0 to 5.5 mc); the resulting signal is the sideband of a frequency between 7.000 to 7.500 mc.

### 6-5. 20 METER OPERATION.

Operation on 20 meters is essentially the same as 80 meters except that "sum" mixing is employed in place of "difference" mixing at 3rd mixer, V8. When the VFO output (5.0 to 5.5 mc) is mixed with the upper or lower sideband at 9 mc, the resulting signal is the sideband of a frequency between 14.000 mc to 14.5 mc.

### 6-6. 15 METER OPERATION.

The selected sideband (upper or lower) at 9 mc is mixed (difference) at 2nd mixer, V7, with a 25 mc signal from heterodyne oscillator V6; the output of V7 is a sideband of a 16 mc signal. This signal is applied to 3rd mixer, V8, where it is mixed (sum) with the 5.0 mc to 5.5 mc output of the VFO, V9. The result of the mixing action is a sideband of a frequency from 21.0 mc to 21.5 mc.

### 6-7. 11 METER OPERATION.

For 11 meter operation the "upper" or "lower" sideband at 9 mc is mixed (difference) at 2nd mixer, V7, with a 30.9 mc output signal of heterodyne oscillator, V6. The resulting signal, a sideband at 21.9 mc, is again mixed at 3rd mixer, V8, with the VFO output signal (5.0 to 5.5 mc). The output of V8 is then a sideband of a frequency from 26.9 mc to 27.4 mc.

### 6-8. 10 METER OPERATION.

Four distinct ranges are provided for complete coverage of the 10 meter band. Each range utilizes a separate frequency from the heterodyne oscillator, V6. The operation in the four ranges is as follows:

1. 28 mc to 28.5 mc. - The selected sideband at 9 mc is mixed (difference) at 2nd mixer, V7, with a 32.0 mc signal from heterodyne oscillator V6. The resulting signal, a sideband at 23.0 mc is applied to 3rd mixer, V8. In this stage, the sideband at 23.0 mc is mixed (sum) with the VFO output (5.0 mc to 5.5 mc). The resulting signal is a sideband at a frequency between 28.0 mc to 28.5 mc.

2. 28.5 mc to 29 mc. - For this range, the 9 mc sideband is mixed (difference) with the 32.5 mc signal from heterodyne oscillator V6, in 2nd mixer V7. The resulting signal, a sideband at 23.5 mc, is mixed (sum) in the 3rd mixer, V8, with the 5.0 mc to 5.5 mc output of the VFO. The output of V8 is a sideband at a frequency between 28.5 mc to 29 mc.

3. 29 mc to 29.5 mc. - As in the above two ranges, the selected sideband of the 9 mc signal from V5 is applied to 2nd mixer, V7. Here it is mixed (difference) with the 33 mc output of V6. The output of V7 is a sideband at 24 mc. This signal is mixed (sum) in 3rd mixer, V8, with the VFO output. The resulting signal is a selected sideband at a frequency between 29 mc to 29.5 mc.

4. 29.5 mc to 30 mc. - For operation in this range, the heterodyne oscillator, V6, injects a 33.5 mc signal in V7 and is mixed (difference) with the selected sideband at 9 mc. The resulting frequency, a sideband at 24.5 mc is mixed (sum) in V8 with the 5.0 mc to 5.5 mc output of the VFO. The output of V8 is a sideband at a frequency between 29.5 mc to 30 mc.

### 6-9. CW OPERATION.

When the FUNCTION control is set to CW or DSB position it unbalances the "bridged-T" modulator network, allowing a carrier to be amplified and heterodyned to the desired output frequency. Two sections of the FUNCTION switch bypasses the 4.95 mc filter (V2 and associated circuitry) in the "CW" or "DSB" position. With these exceptions, CW operation is the same as SSB operation.

### 6-10. DSB (AM) OPERATION.

As in CW operation, the carrier frequency is present in the signal and the 4.95 mc filter is bypassed. Amplitude modulation of the carrier occurs across diode modulator V14. The resulting signal is amplified and heterodyned as in CW and SSB operation.

# SECTION VII

# HT-32 SERVICE AND ALIGNMENT PROCEDURES

(Figures 8 and 9 Cover These Procedures)

## 7-1. EQUIPMENT REQUIRED.

1. RF Signal Generator — Measurements Corp. Model 65B or equivalent having a 1V RMS output at an impedance of 70 OHMS or less. (A 100 mmf DC blocking capacitor must be placed in series with the RF lead.)
2. Vacuum tube voltmeter (VTVM) — Hewlett Packard 410A or equivalent having an RF probe good to 35 MC.
3. Dummy load — 50 ohms non-inductive, rated at 100 watts. The dummy load may be made up of carbon resistors, Bird Wattmeter, or equivalent.
4. DC Milliammeter 0 - 300 MA DC.
5. Oscilloscope — with external vertical plate connection.
6. Receiver (3-30 MC range) with 50 KC calibrator.

## 7-2. INITIAL CONTROL SETTINGS.

| | |
|---|---|
| OPERATION | STANDBY (Power on) |
| FUNCTION | DSB |
| CALIBRATE LEVEL | 0 |
| DRIVER TUNING | Fully counterclockwise (Closed gang) |
| FINAL TUNING | ON INDEX (Closed gang) |
| FREQUENCY | Fully counterclockwise (Closed gang) |
| BAND SELECTOR | As instructed |
| AUDIO LEVEL | 0 |
| METER COMPRESSION | 10 |
| RF LEVEL | 0 |

## 7-3. BIAS ADJUSTMENT.

Check the bias voltage before running any extensive checks with the plate and screen voltage applied to the 6146 final amplifier tubes. Set BIAS ADJ. for -49V DC ±1V with the OPERATION switch at MOX., FUNCTION switch at either upper or lower sideband (zero signal). Line voltage 117V.

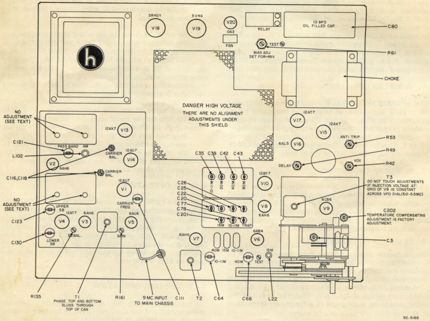

5R4GY
V18
5V4G
V19
V20
OA2
FAN
RELAY
10 MFD
OIL FILLED CAP.
C80
TEST
BIAS ADJ
SET FOR-49V
R61
CHOKE
h
DANGER HIGH VOLTAGE
THERE ARE NO ALIGNMENT
ADJUSTMENTS UNDER
THIS SHIELD
NO
ADJUSTMENT
(SEE TEXT)
12AX7
V13
C121
PASS BAND
AM
L102
CARRIER
BAL.
12AU7
V14
V2
6AH6
C116,C118
CARRIER
BAL.
12AU7
V1
NO
ADJUSTMENT
(SEE TEXT)
CARRIER
FREQ.
UPPER
SB
C123
12AT7
V4
6AH6
V3
6AU6
V5
SB BAL.
GAIN
C130
LOWER
SB
12AT7
V17
12AX7
V15
ANTI TRIP
R53
6AL5
V16
R49
DELAY
VOX
R42
C35
C38
C42
C43
10-11M
20M
40M
80M
12BY7
V10
C26
C25
C22
C20
C77
C78
C201
15M
10-11M
TRAP
V8
6AH6
T3
DO NOT TOUCH ADJUSTMENTS
IF INJECTION VOLTAGE AT
GRID OF V8 IS CONSTANT
ACROSS VFO DIAL(5.0-5.5MC)
6CB6
V9
C202
TEMPERATURE COMPENSATING
ADJUSTMENT IS FACTORY
ADJUSTMENT.
C3
6AH6
V7
6AB4
V6
40M
15M
10-11M
10-11M
40M
TEST
15M
R135
T1
PHASE TOP AND BOTTOM
SLUGS THROUGH
TOP OF CAN
R161
9 MC INPUT
TO MAIN CHASSIS
C111
T2
C64
C66
L22
92-5168

Figure 8. Top Chassis Alignment Points

## 7-4. RF ALIGNMENT 2ND AND 3RD MIXER AND DRIVER STAGES.

IMPORTANT: The RF alignment should only be attempted when a transmitter-exciter malfunction has been analyzed and definitely traced to RF mis-alignment.

Remove 21.5, 25, and 32.5 MC xtals; Osc. Tube V9; HV Rect V18; and 9 MC RF cable from SB generator. Disconnect screen lead of V11 (6146, Final Amp) from lug — of terminal board on underside of chassis. Set neutralization capacitor C44 and VFO coupling capacitor C15 at mid-capacity, if this is to be a complete alignment.

To place the transmitter in operation for alignment, set OPERATION control at MOX. This places operating bias on the 3rd mixer and driver stages.

## 7-5. 3RD MIXER AND DRIVER STAGES.

ALIGNMENT CHART

| Step | Band | Signal Generator Connection | VTVM Connection | Trimmer Adjust for Maximum | Coil Adjust for Maximum | Signal Generator Freq. MC | | Approx. Driver Tuning Setting | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | $f_1$ | $f_2$ | $D_1$ | $D_2$ |
| 1 | 80M | High Side to Pin #1 grid of V8 (6AH6, 3rd Mixer) Common side to chassis. (Generator leads must be kept to absolute minimum to prevent regeneration.) | VTVM to Pin #5 grid of V11 (6146 Final Amp). Common to chassis. | C26<br>C43 | L7<br>L11 | 3.5 | 4.0 | 1.3 | 3.7 |
| 2 | 40M | Same as step 1. | Same as step 1. | C25<br>C42 | L6<br>L10 | 7.0 | 7.3 | 0.9 | 4.1 |
| 3 | 20M | Same as step 1. | Same as step 1. | C22<br>C38 | L5<br>L9 | 14.0 | 14.35 | 1.5 | 3.6 |
| 4 | 15M | Same as step 1. | Same as step 1. | | L5<br>L9 | 21.0 | | 2.1 | |
| 5 | 11-10M | Same as step 1. | Same as step 1. | C20<br>C35 | L4<br>L8 | 26.9 | 29.7 | 0.3 | 4.6 |

## 7-6. ALIGNMENT PROCEDURE.

1. The 3rd mixer and driver stages alignment procedure for 80, 40, 20 and 11-10 meter bands, is essentially the same, differences being only in frequency used and adjustment location which can be obtained from the chart above. The following is the alignment procedure for 80 meters. Preset the Initial Control Settings with the BAND SELECTOR set on the band being aligned (80M).

   (a) Set trimmers (C26 and C43) to mid-capacity.

   (b) Preset slugs (L7 and L11) to their maximum inductance) if they have never been previously aligned.

   (c) Set the DRIVER TUNING to $D_1$ (1.3 on Knob).

   (d) Set the R.F. Generator to $f_1$ (3.5 MC) using sufficient generator output to obtain a readable indication on the VTVM. If 1V out of the signal generator does not provide a VTVM reading proceed with slug adjustment below.

   (e) Carefully adjust each slug (L7 and L11) for maximum deflection on VTVM. Use reference voltage on VTVM of approximately 20V RMS.

   (f) Adjust the output frequency of the R.F. generator to $f_2$ (4.0 MC) using sufficient generator output to obtain about 20V RMS at the grid.

   (g) Tune DRIVER TUNING for maximum deflection on VTVM. Driver tuning setting should be approximately $D_2$ (3.7 on the Knob).

   (h) Adjust trimmers (C26 and C43) for maximum deflection on VTVM.

   (i) Repeat steps (c) thru (h) until the adjustments result in no appreciable increase in grid voltage. The band is then correctly tracking with maximum output.

2. The 3rd Mixer and Driver Alignment procedure for 15M is slightly different, since the 20M and 15M bands share the same coil. The following is the alignment procedure for 15 meters.

   (a) Align 20 meter band as outlined above.

   (b) Set BAND SELECTOR at 15M.

   (c) Set the R.F. generator at $f_1$ (21.0 MC) using sufficient generator output to obtain about 20V RMS at the grid of the final amplifier.

(d) Tune **DRIVER TUNING** for maximum deflection of VTVM. Driver tuning setting should be approximately D. (2.1 on the knob)

(e) Adjust slugs (L5 and L9) for maximum deflection of VTVM. If additional, gain is obtained with this adjustment, repeat 20 meter trimmer alignment at 14.35 MC and check 14.0 MC for uniform gain on 20M band.

(f) Repeat above procedure until no further gain can be obtained on both bands.

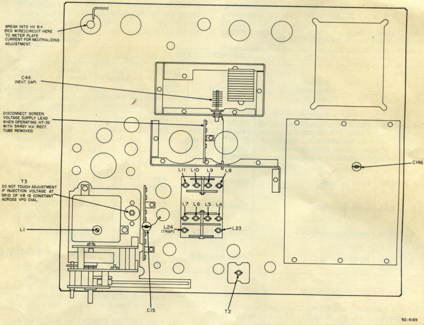

BREAK INTO HV B+ (RED WIRE) CIRCUIT HERE TO METER PLATE CURRENT FOR NEUTRALIZING ADJUSTMENT.
C44 (NEUT. CAP)
DISCONNECT SCREEN VOLTAGE SUPPLY LEAD WHEN OPERATING HT-32 WITH 5R4GY H.V. RECT. TUBE REMOVED.
T3 DO NOT TOUCH ADJUSTMENT IF INJECTION VOLTAGE AT GRID OF V8 IS CONSTANT ACROSS VFO DIAL.
L1
L11
L10
L9
L8
L7
L6
L5
L4
L24 (TRAP)
L23
C146
C15
T2
92-5169

Figure 9. Bottom Chassis Alignment Points

## 7-7. 2ND MIXER STAGE

| ALIGNMENT CHART | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Step | Band | Signal Generator Connection | VTVM Connection | Trimmer Adjust for Maximum | Slug Adjust for Maximum | Signal Generator Freq. (MC) | | VFO Freq. (MC) |
| | | | | | | f$_1$ | f$_2$ | |
| 1 | 40M | High side to pin #1 grid of V7 (6AH6, 2nd Mixer). Common side to chassis. | VTVM to pin #5 grid of V11 (6146, Final Amp.). Common to chassis. | | L23 | 7.2 | 12.5 | 7.2 |
| 2 | 15M | Same as step 1. | Same as step 1. | C201 | | 21.0 | 16.0 | 21.0 |
| 3 | 11- | Same as step 1. | Same as step 1. | C78 | | 29.0<br>27.4 | 23.5<br>21.9 | 29.0<br>27.4 |

### 7-8. ALIGNMENT PROCEDURE.

The 2nd mixer alignment procedure must follow the sequences shown in the chart, since the setting of the coil inductance on 40M must precede the trimmer adjustments on 15M and 10-11M bands. The following is the alignment procedure for 40 meters.

1. Set BAND SELECTOR at 40M.
2. Set trimmers C201 and C78 at mid-capacity.
3. Set slug (L23) at it's maximum counterclockwise position (minimum inductance).
4. Set Signal generator at $f_1$ (7.2 MC) with sufficient output to permit setting the driver tuning to resonance.
5. Adjust DRIVER TUNING for maximum deflection on VTVM.
6. Set BFO dial to 7.2 MC.
7. Set R.F. generator at $f_2$ (12.5 MC). Set generator output for approximately 20V RMS at the final grid while making alignment adjustments.
8. Adjust mixer coil slug L23 for maximum deflection on VTVM.
9. Proceed with the alignment of the 2nd mixer stage on 15M and 10-11M using the chart and the above procedures used on 40M.

NOTE

The above alignment data for 10-11M 2nd mixer adjustment covers the 28.5-29.0 MC 10M segment (32.5 MC xtal) supplied with the HT-32 Transmitter/Exciter. For alignment instructions covering the use of other 11M or 10M 0.5 MC segments, refer to SEGMENT ALIGNMENT for 10-11M BAND in paragraph 4-7.

The 2nd mixer plate frequency ($f_2$) for the various crystals used on the 10-11M band are as follows:

| Trans. freq. range | Xtal freq. | 2nd Mixer freq. ($f_2$) |
|---|---|---|
| 26.9 - 27.4 MC | 30.9 MC | 21.9 MC |
| 28.0 - 28.5 MC | 32.0 MC | 23.0 MC |
| 28.5 - 29.0 MC | 32.5 MC | 23.5 MC |
| 29.0 - 29.5 MC | 33.0 MC | 24.0 MC |
| 29.5 - 30.0 MC | 33.5 MC | 24.5 MC |

### 7-9. HETERODYNE XTAL OSCILLATOR ALIGNMENT

ALIGNMENT CHART

| Step | Band Selector | VTVM Connection | Trimmer Adjustment | Coil Adjustment | Injection Level |
|---|---|---|---|---|---|
| 1 | 15M | VTVM to pin #1 of V7 (6AH6, 2nd Mixer). Common side to chassis. | | L22 | 0.25V RMS<br>.705 P/P |
| 2 | 40M | VTVM to pin #1 of V7 (6AH6, 2nd Mixer). Common side to chassis. | C66 | | 0.5 V RMS<br>1.41 P/P |
| 3 | 11-10M | VTVM to pin #1 of V7 (6AH6, 2nd Mixer). Common side to chassis. | C64 | | 0.5 V RMS<br>1.41 P/P |

### 7-10. ALIGNMENT PROCEDURE.

The heterodyne crystal oscillator alignment procedure must follow the sequence shown in the chart, since the setting of the coil inductance on 15M must precede the trimmer adjustments on 40M and 10-11M bands.

1. Set BAND SELECTOR at 15M.
2. Adjust Xtal Osc coil slug (L22) for 0.25V RMS on the gentle slope side of resonance.
3. Set BAND SELECTOR at 40M.
4. Adjust Xtal Osc trimmer C66 for 0.5V RMS on the gentle slope side of resonance.
5. Set BAND SELECTOR at 11-10M.
6. Adjust Xtal Osc trimmer C64 for 0.5V RMS on the gentle slope side of resonance.

### 7-11. VFO CALIBRATION ALIGNMENT.

The VFO unit has been carefully aligned and temperature compensated at the factory. Before touching up trimmer C3 or coil L1 check the dial calibration at the 100KC points. If all points fall to one side of the pointer, reset the pointer position. If, the calibration "runs out" across the dial proceed as follows:

1. Set OPERATION control at STANDBY.

2. Place the antenna lead of the receiver near the VFO unit and set the receiver at 5.0 MC with the 50 KC calibrator. Receiver BFO turned off.

3. Tune the VFO unit to 4000 kc on 80M.

4. Adjust slug L1 for zero-beat.

5. Set the receiver to 5.5 MC with the 50 DC calibrator at zero beat.

6. Tune the VFO unit to 3500 kc on 80M.

7. Adjust air trimmer C3 for zero beat.

8. Repeat steps 2, 3, 4, 5, 6, and 7 until calibration is obtained at either end of the dial scale.

### 7-12. RF ALIGNMENT 9 MC AMPLIFIER STAGES.

| Signal Generator Connection | Signal Generator Frequency | VTVM Connection | Control Setting | Remarks |
|---|---|---|---|---|
| High Side to Pin #1 Grid of V3 (6AH6, 1st Mixer) Common to chassis | 9 MC (Unmod.) | VTVM RF probe to pin #5 Plate of V7 (6AH6, 2nd Mixer.) Common side to chassis | BAND SELECTOR, 20M. OPERATION, Standby. RF LEVEL, 10. (All other controls at initial control setting.) | Remove OSC. tubes V1, V4. Peak upper and lower core adjustments of T1 and T2 for maximum deflection of VTVM. (1V RMS) |

### 7-13. CARRIER OSC. AND SIDEBAND SWITCHING OSC. ALIGNMENT.

The carrier oscillator and sideband switching oscillators are provided with minor frequency correction trimmers which permit setting each oscillator to exact frequency. The object of the oscillator frequency adjustment in the sideband generator unit is to provide a carrier signal frequency of exactly 9000 kc. This is accomplished by heterodyning the carrier oscillator frequency (4950 kc) with either the 4050 kc or 13,950 kc sideband switching oscillator to produce a 9000 kc signal at the output of the sideband unit.

### 7-14. CARRIER OSCILLATOR

Ordinarily the carrier oscillator will not require adjustment in the field. If the 9 MC signal is not on frequency, adjust the sideband switching oscillators only. In cases where the carrier oscillator frequency must be set, proceed as follows:

1. Set the OPERATION switch at the MOX position.

2. Set the FUNCTION switch at DSB.

3. Tune up the transmitter on 80M into a dummy load.

4. Reset the FUNCTION switch for either USB or LSB.

5. Set the two CARRIER BAL. trimmers on the sideband unit for maximum carrier level and if necessary detune with the DRIVER TUNE control to prevent over-driving the final.

6. Adjust the CARRIER FREQ. trimmer (C-111) for maximum carrier level, again detuning with the DRIVER TUNE control to prevent driving the final stage into a saturation output.

7. Set the carrier level with the DRIVER TUNE control for 50V RMS across the dummy load, or use the output meter on the transmitter taking care to avoid driving the final into the saturation level. Set the output meter sensitivity for zero db.

8. Decrease the carrier oscillator frequency by turning the CARRIER FREQ. trimmer until the carrier level drops 20 db to 30 db.

NOTE. The carrier oscillator frequency may not fall exactly on 4950 kc which is stated in the manual as the nominal frequency.

9. Rebalance for maximum carrier suppression with the carrier balance trimmers. Retune the driver stage and check the low frequency audio response. Use a 50V RMS RF output level at 1000 CPS audio reference frequency. The low frequency response for -3 db will fall between 500 CPS and 650 CPS.

NOTE. The low frequency audio response is directly governed by the CARRIER OSCILLATOR frequency. The carrier frequency is set in this manner to insure carrier suppression of 40 db or more after a 30 minute warm-up.

10. Check the audio frequency response at the high end of the range. The output level should fall -3 db at 3000 to 4000 CPS. If adjustment is required, adjust the AM coil (L-102) for the correct response.

NOTE. A change in the AM coil adjustment will generally require an adjustment of trimmer C-146, in order to repeak the carrier level output for DSB or CW operation.

11. After the carrier frequency has been set, it is now necessary to adjust the sideband switching

oscillators for exactly 9000 kc from the sideband unit as described in para. 7-15.

## 7-15. SIDEBAND SWITCHING OSCILLATORS.

1. Set band switch at 80M.
2. Disconnect shielded cable from sideband unit at main chassis connector.
3. Place antenna lead of receiver near the center terminal of the shielded plug and set the receiver at 9000 kc, with the crystal calibrator. Receiver BFO turned off.
4. Set the FUNCTION switch at LSB.
5. Adjust LOWER SB osc. trimmer (C130) for zero beat.
6. Set the FUNCTION switch at USB.
7. Adjust UPPER SB osc. trimmer (C123) for zero beat.

NOTE: It may be desirable to unbalance the carrier balance adjustments slightly to obtain a higher signal level for the receiver.

## 7-16. SIDEBAND BALANCE ADJUSTMENT.

The SB BAL control is a potentiometer (R-135) in the cathode circuits of the 4.05 MC oscillator and 13.95 MC oscillator (V4) stages. This control is utilized to maintain sideband amplitude symmetry and may not require adjustment throughout the use of the transmitter-exciter. However, if adjustment is necessary, proceed as follows:

1. Tune the transmitter-exciter for SSB operation, using a 1000 cps audio tone.

2. Set the FUNCTION switch at "UPPER SIDEBAND" and note the reading of the front panel meter. Set AUDIO LEVEL control for approximately mid-scale reading.

3. Set the FUNCTION switch at "Lower Sideband". The meter indication for both "UPPER" and "LOWER SIDEBAND" should be essentially the same. Any difference in output between the 4.05 MC oscillator and 13.95 MC oscillator can be compensated by adjusting the SB BAL control. Rotating the SB BAL control will increase the output of one sideband and decrease the other simultaneously. Consequently, it is necessary to alternate between the "UPPER" and "LOWER SIDEBAND" positions of the FUNCTION switch, checking for equal output, while adjusting the SB BAL control.

4. There is a slight interaction between the SB BAL adjustment and SB frequency adjustment, hence a relatively large change in one will effect the performance of the other. If a large correction in sideband balance is required, check the sideband switching oscillator frequency adjustment again.

## 7-17. NEUTRALIZATION OF FINAL AMPLIFIER.

Although a signal generator is used here for this adjustment, the carrier on DSB or CW generated by the transmitter may be used on the 10M and 15M bands.

1. Connect signal generator to pin #1 of V7 (2nd mixer) through 100 uuf capacitor. Common side to chassis.

2. Connect dummy load to transmitter output.

3. Remove heterodyne oscillator tube (V6) and 9 MC output cable from sideband generator unit.

4. Connect 0-300 MA milliammeter in H.V. plate lead between the filter capacitor (C80) and shunt feed choke (L16).

5. Insert HV rectifier and reconnect screen supply lead.

6. Set neutralizing capacitor at mid-capacity.

7. Set OPERATION switch at MOX. and frequency dial at mid position.

8. Set BANDSWITCH at 10-11M, signal generator at 23 MC and adjust DRIVER and FINAL TUNING for maximum output. Set signal generator output for 150-175 ma plate current.

9. Tune FINAL TUNE control for plate current dip and observe output meter. Adjust neutralization capacitor until the output meter passes through maximum at the same time the plate current passes through the resonant dip.

10. Set BANDSWITCH at 15M, signal generator at 16 MC and repeat the above procedure.

11. If the neutralization capacitor setting does not change, the adjustment is complete. If a small change in setting occurs, set the capacitor half way between the two settings and recheck with this compromise setting.

## 7-18. CARRIER BALANCE ALIGNMENT.

The CARRIER BAL C116 and C118 are air trimmers located at the top side of the sideband generator unit. The adjustment of trimmer C116 tunes the Bridged T coil to resonance and the adjustment of trimmer C118 adjusts the phase of the Bridged T network so that the carrier frequency is balanced out, when operating in either side band position of the FUNCTION switch. The best working carrier balance adjustment will be obtained if adjustment is made after the transmitter has reached a normal operating temperature, which is usually in about 2 to 3 hours.

1. Tune the transmitter-exciter for DSB operation.
2. Set FUNCTION switch to one sideband position.
3. Adjust C116 and C118 systematically for maximum carrier suppression. (Minimum output meter reading.)
4. Set FUNCTION switch to the other sideband position.
5. Re-adjust C116 and C118 until the maximum carrier suppression is equalized in both sideband positions.

### 7-19. VFO INJECTION ADJUSTMENT.

This adjustment is a coupling trimmer in the output of the VFO unit which governs the amount of VFO injection voltage applied to the 3rd mixer stage.

1. Set BAND SELECTOR at 15M.
2. Set VFO dial to 21.33 MC.
3. Tune the transmitter-exciter for DSB operation into 50-ohm load.
4. Disconnect 9 MC cable input from SB generator.
5. Adjust VFO coupling trimmer (C15) for 0.1 RMS RF output across 50 ohms.
6. Connect VTVM probe to pin #1 grid of V8 (6AH6, 3rd Mixer). The injection voltage will be approximately 0.3 to 0.4V RMS. If below 0.3V check screen and bias voltages on tubes V8 and V10 and check tubes V8 and V10 for malfunction.
7. Replace 9 MC cable input from SB generator and tune for maximum saturated power output, which should be at least 60V RMS across 50 ohm load.

### 7-20. 10 METER TRAP COIL ADJUSTMENT.

This adjustment should be made with a 33.5 MC crystal in the 11-10 meter heterodyne osc. xtal socket. If the 33.5 MC xtal is not available to the operator, the 32.5 MC xtal supplied with the HT-32 may be used to adjust the trap coil. However, when higher frequency xtals are installed, the trap coil must then be reset as outlined below.

1. Preset the trap trimmer (C-77) to minimum capacity (slot toward center of RF deck). See Figure 5.
2. Preset the trap coil slug (L-24) for minimum inductance (maximum counterclockwise).
3. Tune the transmitter for CW operation on the 10M band.
4. Set the FUNCTION switch at LSB.
5. Adjust DRIVER TUNING and FINAL TUNING for the spurious output. (33.5 MC Xtal - VFO frequency = 28.0 to 28.5 MC.)
6. Adjust trap coil slug L-24 for minimum output.
7. Increase trap trimmer capacity slightly, and reset the trap coil slug for minimum output. Use just enough capacity in the trap trimmer to observe two resonant dips in the spurious output when the trimmer is rotated through minimum capacity.
8. Set FUNCTION switch at DSB.
9. Tune DRIVER TUNING and FINAL TUNING to desired frequency between 29.5 - 29.7 MC.
10. Readjust 10-11M 2nd mixer trimmer (C-78) for maximum output with RF LEVEL slightly advanced.
11. Set FUNCTION switch at LSB.
12. Retune DRIVER TUNING and FINAL TUNING for spurious output.
13. Adjust trap coil slug for minimum spurious output and repeat step 10 to be sure the mixer stage is resonant.
14. When crystals other than the 33.5 MC crystals are now used on the 10M band, it is only necessary to adjust the trap trimmer. The trap coil adjustment is left as adjusted for the highest frequency crystal.

### 7-21. 9 MC GAIN ADJUSTMENT ON SIDEBAND UNIT.

This control (R-161) is located on the sideband generator unit and is accessible at the top of its chassis. The control sets the gain of the 9 MC amplifier and is considered a factory adjustment which will generally not require readjustment unless extensive service work has been done on the equipment.

Before changing the adjustment, check the performance of the transmitter as follows:

1. Tune up the transmitter on single sideband using a dummy load. With a 1000 cps audio oscillator, measure the audio signal level at the microphone connector for peak or saturation power output on each of the bands.
2. The audio signal level at the microphone input should run between 2 to 4 millivolts rms for saturation or peak power output. Should any one band require substantially more audio signal level than the rest, re-check the alignment on that band.
3. If the audio level required is uniformly higher on all bands, advance the 9 MC amplifier gain adjustment to bring it into agreement with the level specified in step 2. If the audio level required runs less than 2 millivolts, the gain is excessively high and will not permit the carrier suppression and unwanted sideband to reach 50 db below maximum output. In this case reduce the gain setting accordingly.

### 7-22. CRYSTAL FILTER ALIGNMENT.

Due to the specialized techniques and test equipment required it is recommended that realignment of the filter units (FL1 and FL2) be handled through the company service department. The operation of the filter can be checked out as follows to determine whether the filter requires realignment.

1. Tune up the transmitter for single sideband operation into a 50-ohm load.
2. With a 1000 cps audio generator, adjust the transmitter output for zero db reference on the output meter with the METER COMPRESSION set for maximum meter sensitivity. This will permit operating the transmitter well below the saturation output level.
3. Hold the generator output voltage constant and check the transmitter output at 650 cps and 3000 cps. The transmitter output should not drop below approximately 3 db at these extremes of the audio passband. If the transmitter output vs frequency is tilted, the correction may be made by adjusting the PASSBAND trimmer (C-121) located on the top deck of the sideband unit.

# SERVICE PARTS LIST

### CAPACITORS (MAIN CHASSIS)

| Schematic Symbol | Description | Hallicrafters Part Number |
|---|---|---|
| C-1 | 12 mmf, ±5%, N1500; Ceramic | 479-015120 |
| C-2 | 12 mmf, ±5%, NPO; Ceramic | 491-005120-22 |
| C-3 | 2. 6-13. 3 mmf, Variable Trimmer | 048-000376 |
| C-4 | 18 mmf, ±5%, N80; Tubular Ceramic | 491-005180-42 |
| C-5, 6 | 1000 mmf, 5%, 300V; Mica | 047-100623 |
| C-7, 9 | . 01 mfd, 10%, 300V; Mica | 470-643103 |
| C-8, 10, 51, 52, 60, 61, 84, 86, 87, 88 | . 01 mfd, 500V; Ceramic Disc. | 047-000224 |
| C-11 | 6 mmf, 10%, NPO; Ceramic | 491-006060-22 |
| C-12, 14 | Part of T3 (47 mmf) | ------------- |
| C-13 | Part of T3 (470 mmf) | ------------- |
| C-15 | 1. 5-7 mmf, Variable Trimmer | 044-100457 |
| C-16, 30 | 47 mmf, 10%, N750; Ceramic | 491-106470-95 |
| C-17, 18, 29, 31, 32, 37, 46, 47, 48, 49, 50, 62, 63, 72, 73, 90, 91, 92, 93, 94, 95, 96, 97 | . 005 mfd, 20%; Ceramic Disc. | 047-100442 |
| C-19, 75 | . 005 mfd, 20%, 1KV; Ceramic Disc. | 047-100523 |
| C-20, 22, 25, 26, 35, 38, 42, 43 | 5-25 mmf, NPO, Trimmer Strip (4 Section) | 044-200464 |
| C-21, 36 | 110 mmf, 2%; Fixed Ceramic | 491-154111-73 |
| C-23, 39 | 82 mmf, 5%; Fixed Ceramic | 491-155820-63 |
| C-24, 41 | 240 mmf, 2%; Mica | 470-231241 |
| C-27 | 47 mmf, 2%; Fixed Ceramic | 491-024470-22 |
| C-28 A, B, C, D | Variable, Driver Tuning | 048-400381 |
| C-33 | 33 mmf, 2%; Fixed Ceramic | 491-024330-22 |
| C-34 | . 0027 mfd, 20%, 1KV; Cer. Disc. | 047-200524 |
| C-40 | 2000 mmf, Feed-thru; Mica | 047-200669 |
| C-44 | 2-13 mmf, Variable | 048-200316 |
| C-45 | 100 mmf, 10%, N750; Ceramic | 491-126101-95 |
| C-53, 54 | . 001 mfd, 3000V; Ceramic Disc. | 047-100397 |
| C-55 | Variable, Final Tune | 048-400386 |
| C-56 | 380 mmf, Toothpick | 047-100668 |
| C-57 | 220 mmf, Toothpick | 047-000596 |
| C-58, 59 | 270 mmf, 2%; Fixed | 470-221271 |
| C-64 | 5-25 mmf, Trimmer | 044-100473 |
| C-65 | 39 mmf, 2%, NPO; Tubular Ceramic | 491-124390-22 |
| C-66 | 8-50 mmf, N750, Trimmer | 044-200437 |
| C-67 | 43 mmf, 5%, N750; Ceramic Tubular | 491-105430-95 |
| C-68 | 5 mmf, 10%, N750; Ceramic | 491-106050-95 |
| C-69, 70 | Part of T2 (56 mmf) | ------------- |
| C-71 | 68 mmf, 5%, N750; Tubular Ceramic | 491-125680-95 |
| C-74 | 200 mmf, 2%; Mica | 470-231201 |
| C-76 | 68 mmf, 5%; Fixed Ceramic | 491-125680-63 |
| C-77, 78, 201 | Ceramic Trimmer Strip (3 Section) | 044-200474 |
| C-79A, 79B | 60-40 mfd, 475V; Electrolytic | 045-200226 |
| C-80 | 10 mfd, 1000V; Oil Filled | 046-300638 |
| C-81, 82 | . 01 mfd, 1KV; Ceramic Disc. | 047-200598 |
| C-85 | . 22 mfd, 200V; Molded Paper | 499-014224 |
| C-89, 204 | . 1 mfd, 200V; Molded Paper | 499-014104 |
| C-98, 99 | 10 mfd, 150V; Electrolytic | 045-200307 |
| C-202 | Variable, Trimmer | 048-000375 |
| C-203 | Variable, Main Tuning | 048-300343 |

### CAPACITORS (SIDEBAND GEN. ASSEMBLY)

| Schematic Symbol | Description | Hallicrafters Part Number |
|---|---|---|
| C-101 | 200 mmf, 5% Duramic | 482-162201 |
| C-102, 105 | . 001 mfd, 20%, 500V; Ceramic Disc. | 047-100503 |
| C-103 | 10 mfd, 350V; Electrolytic | 045-200415 |
| C-104, 106, 110, 122, 124, 127, 131, 134, 135, 136, 140, 142, 143, 145, 147, 148, 150 | . 005 mfd, 20%; Ceramic Disc. | 047-100442 |
| C-107 | . 02 mfd ±80-20%, 500V; Ceramic Disc. | 047-100242 |
| C-108 | 10 mfd, 150V; Electrolytic | 045-200307 |
| C-109 | . 022 mfd, 10%, 200V; Molded Paper | 499-014223 |
| C-111, 121 123 | 5-25 mmf, Trimmer | 044-100473 |
| C-112 | 33 mmf, 5%; Duramic | 482-162330 |
| C-113 | 120 mmf, 5%; Duramic | 482-162121 |
| C-114 | 68 mmf, 2%, N30; Tubular Ceramic | 491-054680-32 |
| C-115 | 18 mmf, ±5%, N80; Ceramic | 491-005180-42 |
| C-116, 118 | 2-13 mmf, Variable | 048-200316 |
| C-117 | 39 mmf, 5%; Duramic | 482-162390 |
| C-119 | 390 mmf, 5%; Duramic | 481-162391 |
| C-120, 125, 128 | 18 mmf, 5%, NPO; Tubular Ceramic | 491-105180-22 |
| C-126, 129 | 43 mmf, 5%, NPO; Tubular Ceramic | 491-125430-22 |
| C-130 | 3-12 mmf, NPO, Trimmer | 044-200483 |
| C-132 | 47 mmf, 5% NPO; Tubular Ceramic | 491-125470-22 |
| C-133 | . 01 mfd, 500V; Ceramic Disc. | 047-000224 |
| C-137, 139 | Part of T1 | ---------- |
| C-138, 141 | 100 mmf, 10%, N750; Ceramic | 491-126101-95 |
| C-144 | 100 mmf, 5% NPO; Ceramic | 491-065101-22 |
| C-146 | 8-50 mmf, N750, Trimmer | 044-200484 |
| C-149 | 5 mmf, 10%, N750; Ceramic | 491-106050-95 |

### *RESISTORS (MAIN CHASSIS)

| Schematic Symbol | Description | Hallicrafters Part Number |
|---|---|---|
| R-1, 6, 32 | 47K ohms, 10%, 1/2W | 451-252473 |
| R-2, 13, 15 | 22K ohms | 451-352223 |
| R-3, 55, 58, 64 | 4. 7K ohms | 451-352472 |
| R-4 | 1K ohms, 10%, 1/2W | 451-252102 |
| R-5 | 3. 9K ohms, 10% 1/2W | 451-252392 |
| R-7, 25 | 220K ohms, 5%, 1/2W | 451-251224 |
| R-8 | 47K ohms | 451-352473 |
| R-9, 19, 31, 38, 39 | 1K ohm | 451-452102 |
| R-10, 28 | 100K ohms, 10%, 1/2W | 451-252104 |
| R-11 | 39K ohms, 10%, 2W | 451-652393 |
| R-12 | 12K ohms, 10%, 2W | 451-652123 |
| R-14, 63 | 18K ohms | 451-352183 |
| R-16 | 10K ohms, 5% | 451-351103 |
| R-17, 18 | 100 ohms | 451-452101 |
| R-20 | 6. 8K ohms, 5%, 2W | 451-551682 |
| R-21 | 1. 2K ohms, 5% | 451-351122 |
| R-22 | 5. 6K ohms, 5%, 1/2W | 451-251562 |
| R-23 | 50K ohms, Meter Compression | 025-301413 |
| R-24 | 22K ohms, 10%, 1/2W | 451-252223 |
| R-26 | 15K ohms, 5%, 1/2W | 451-251153 |
| R-27 | 47 ohms, 10%, 1/2W | 451-252470 |
| R-29 | 10K ohms, 10%, 1/2W | 451-252103 |
| R-30 | 220 ohms | 451-352221 |
| R-33, 34, 51 | 470 ohms | 451-352471 |
| R-35 | 27K ohms | 451-352273 |
| R-36, 47, 59 | 100K ohms | 451-352104 |
| R-40 | 1. 5K ohms, 5%, 10W | 453-061152 |
| R-41 | 2. 5K ohms, 5%, 10W | 453-061252 |
| R-42 | 1 megohm, Vox | 025-201137 |
| R-43, 56 | 1 megohm, 10%, 1/2W | 451-252105 |
| R-44, 54, 57 | 330K ohms | 451-352334 |
| R-45 | 1. 2K ohms | 451-352122 |
| R-46 | 220K ohms, 10%, 1/2W | 451-252224 |
| R-48 | 820K ohms | 451-352824 |

### *RESISTORS (MAIN CHASSIS Cont.)

| Schematic Symbol | Description | Hallicrafters Part Number |
|---|---|---|
| R-49 | 5 megohms, Delay | 025-201141 |
| R-50 | 82K ohms | 451-352823 |
| R-52 | 1. 5K ohms | 451-352152 |
| R-53 | 1 megohm, Anti-Trip Sensitivity | 025-201137 |
| R-60, 65, 66 | 1 megohm | 451-352105 |
| R-61 | 10K ohms, Bias Adj. | 025-201412 |
| R-62 | 12K ohms | 451-352123 |
| R-67, 68 | 220K ohms, 10%, 2W | 451-652224 |
| R-69 | 8. 2K ohms | 451-352822 |
| R-71 | 10K ohms, 5% 1/2W | 451-251103 |
| R-72 | 4. 7K ohms, 5%, 1/2W | 451-251472 |

### *RESISTORS (SIDEBAND GENERATOR)

| Schematic Symbol | Description | Hallicrafters Part Number |
|---|---|---|
| R-101, 130 144, 147 | 47K ohms | 451-452473 |
| R-102, 103, 113 | 470K ohms | 451-352474 |
| R-104, 105 114, 118, 133, 138, 153 | 100K ohms, 10%, 1/2W | 451-252104 |
| R-106, 109 129 | 4. 7K ohms | 451-452472 |
| R-107, 108 146, 152 | 1 megohm, 10%, 1/2W | 451-252105 |
| R-110 | 1 megohm, Audio Level | 025-301414 |
| R-111, 125 132, 139, 151, 160 | 220K ohms, 10% 1/2W | 451-252224 |
| R-112, 116 117, 134, 145, 148 | 10K ohms | 451-352103 |
| R-115 | 2. 7K ohms | 451-352272 |
| R-119, 131, 136, 137 | 2. 2K ohms | 451-352222 |
| R-120 | 2. 7K ohms, 5%, 1/2W | 451-251272 |
| R-121 | 12K ohms, 5%, 1/2W | 451-251123 |
| R-122, 127, 154 | 1K ohm, 10%, 1/2W | 451-252102 |
| R-123 | 1. 1 megohm, ±10% | 023-100127 |
| R-124 | 220K ohms, 5%, 1/2W | 451-251224 |
| R-126 | 470 ohms, 10%, 1/2W | 451-252471 |
| R-128 | 180 ohms | 451-352181 |
| R-135 | 5K ohms, Oscillator Level | 025-201392 |
| R-140 | 2. 2K ohms, 10%, 1/2W | 451-252222 |
| R-141, 162 | 4. 7K ohms, 10%, 1/2W | 451-252472 |
| R-142 | 470 ohms | 451-452471 |
| R-143 | 100K ohms | 451-452104 |
| R-149 | 50K ohms, Calibrate Level | 025-301415 |
| R-150 | 22K ohms, 5%, 1/2W | 451-251223 |
| R-155 | 470K ohms, 10%, 1/2W | 451-252474 |
| R-156 | 820K ohms, 10%, 1/2W | 451-252824 |
| R-157 | 1. 8 megohms, 10%, 1/2W | 451-252185 |
| R-158 | 120K ohms, 10%, 1/2W | 451-252124 |
| R-159 | 1 megohm, RF Level | 025-301416 |
| R-161 | 300K ohms, Gain Level | 025-201426 |

*Resistors are 10%, 1 watt, unless otherwise noted.

### TRANSFORMERS AND COILS

| Schematic Symbol | Description | Hallicrafters Part Number |
|---|---|---|
| L-1 | Coil Assembly, VFO | 051-202180 |
| L-2 | Choke, VFO Filament | 053-200359 |
| L-3, 13 | Choke, R. F. 2. 5 mh | 053-200335 |
| L-4, 8 | Coil, 11-10M | 051-202015 |
| L-5, 9 | Coil, R. F. 15-20M | 051-202181 |
| L-6, 10 | Coil, 40M | 051-202017 |
| L-7, 11 | Coil, 80M | 051-202018 |
| L-12, 14 | Choke, Parasitic Suppresser | 053-200417 |
| L-15 | Choke, Filament | 053-200358 |
| L-16 | Choke, RF, Final Plate | 053-200426 |
| L-17 | Coil, Final Tank | 051-302229 |
| L-18 | Choke, RF, Safety | 053-100160 |
| L-19, 20 | Coil, XTAL Osc. Grid, 15 & 40M | 051-202251 |
| L-21 | Coil, XTAL Osc. Grid, 10 & 11 M | 051-202250 |
| L-22 | Coil, R. F. Oscillator | 051-202235 |
| L-23 | Coil, R. F. 1st Mixer Plate | 051-202182 |
| L-24 | Coil, 32-33. 5 MC Trap | 051-202234 |
| L-25 | Choke, Filter - 9 HY @ 135 MA | 056-300259 |
| L-26 | Choke, Filter - 8 HY @ 175 MA | 056-300260 |
| L-101 | Coil, Modulator | 051-202247 |

# SERVICE PARTS LIST (Cont.)

### TRANSFORMERS AND COILS (Cont.)

| Schematic Symbol | Description | Hallicrafters Part Number |
|---|---|---|
| L-102 | Coil, Modulator Output | 051-202248 |
| L-103 | Choke, R. F. | 053-100107 |
| T-1, 2 | Transformer, I. F. 9 MC | 050-200701 |
| T-3 | Transformer, VFO Band Pass Filter | 050-200679 |
| T-4 | Transformer, Power | 052-400477 |

### SWITCHES AND WAFERS

| Schematic Symbol | Description | Hallicrafters Part Number |
|---|---|---|
| BS-1, 2 | Switch, Band Selector | 060-200784 |
| BS-3 | Wafer, Switch, 2nd Mixer | 062-200102 |
| BS-4, 5 | Wafer, Switch, 3rd Mixer and Driver | 062-200103 |
| BS-6 | Switch, Wafer | 062-200112 |
| FS | Switch, Function | 060-000822 |
| OS | Switch, Operation | 060-000821 |

### PLUGS, SOCKETS, AND CONNECTORS

| Schematic Symbol | Description | Hallicrafters Part Number |
|---|---|---|
| P-2, 5 | Plug, Phono | 010-100231 |
| P-3 | Plug, 10 Pin | 006-100715 |
| P-4 | Plug, 6 Pin | 006-100714 |
| P-10 | Plug, AC (Part of Fan Motor Assembly) | ---------- |
| P-11 | Line Cord & Plug (Power) | 087-105302 |
| SO-1 | Connector, Mike | 029-100043 |
| SO-2, 5 | Jack, Phono | 036-100041 |
| SO-3 | Socket, 10 Pin | 006-100712 |
| SO-4 | Socket, 6 Pin | 006-100713 |
| SO-6 | Jack, Non Shorting | 036-100064 |
| SO-7 | Jack, Shorting | 036-100002 |
| SO-8 | Socket, Power, 11 Prong | 006-100707 |
|  | Plug, 11 Prong | 035-100043 |
| SO-9 | Connector, Coax | 010-100056 |
| SO-10 | Socket, AC (Fan) | 010-200015 |
|  | Socket, Tube (Octal) Mica | 006-100760 |
|  | Socket Assembly Pilot Light | 086-200297 |
|  | Socket, Tube 7 Pin Min. Cer. | 006-100354 |
|  | Socket, Xtal | 006-100320 |
|  | Socket, Tube, 7 Pin Min. Mica | 006-200759 |
|  | Socket, Tube, 7 Pin Min. | 006-100645 |
|  | Socket, Tube, 9 Pin w/Base | 006-200672 |

### TUBES AND RECTIFIERS

| Schematic Symbol | Description | Hallicrafters Part Number |
|---|---|---|
| V-1, 14 | Tube, Electron Type 6680/12AU7 | 090-901116 |
| V-2, 3, 7, 8 | Tube, Electron Type 6AH6 | 090-900793 |
| V-4, 17 | Tube, Electron Type 12AT7 | 090-900034 |
| V-5 | Tube, Electron Type 6AU6 | 090-900808 |
| V-6 | Tube, Electron Type 6AB4 | 090-900784 |
| V-9 | Tube, Electron Type 6CB6 | 090-901115 |
| V-10 | Tube, Electron Type 12BY7 | 090-900041 |
| V-11, 12 | Tube, Electron Type 6146 | 090-900756 |
| V-13, 15 | Tube, Electron Type ECC83/12AX7 | 090-901230 |
| V-16 | Tube, Electron Type 6AL5 | 090-901163 |
| V-18 | Tube, Electron Type 5R4GY | 090-900705 |
| V-19 | Tube, Electron Type 5V4G | 090-900721 |
| V-20 | Tube, Electron Type 0A2 | 090-900001 |
| SR-1 | Rectifier, Selenium | 027-200224 |

### LAMPS AND FUSES

| Schematic Symbol | Description | Hallicrafters Part Number |
|---|---|---|
| LM-1 | Lamp, Pilot Type #47 Meter | 039-100004 |

### LAMPS AND FUSES (Cont.)

| Schematic Symbol | Description | Hallicrafters Part Number |
|---|---|---|
| LM-2, 3 | Lamp, Pilot Type #44, Dial | 039-100003 |
| F-1 | Fuse, 4 amp, Slo-Blo, 3AG | 039-100448 |

### KNOBS

| Schematic Symbol | Description | Hallicrafters Part Number |
|---|---|---|
|  | Knob, Final Tuning | 015-201049 |
|  | Knob, Operation | 015-201050 |
|  | Knob, Function | 015-200807 |
|  | Knob, Meter Compression | 015-200812 |
|  | Knob, R. F. Level | 015-200812 |
|  | Knob, Audio Level | 015-200812 |
|  | Knob, Calibrate Level | 015-200812 |
|  | Knob, Friction Brake | 015-100899 |
|  | Knob, Main Tuning VFO | 015-201046 |
|  | Knob, Bandswitch | 015-201047 |
|  | Knob, Driving Tuning | 015-100811 |

### CRYSTALS AND DIODES

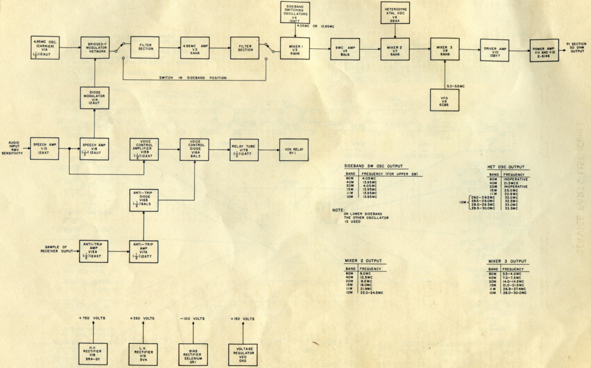
| Schematic Symbol | Description | Hallicrafters Part Number |
|---|---|---|
| CR-1 | Crystal, Carrier Osc. (4950. 000 KC) | 019-001956 |
| CR-3 | Crystal, Sideband Rev. (4050. 000 KC) | 019-001957 |
| CR-4 | Crystal, Sideband Rev. (13950. 000 KC) | 019-001958 |
| CR-5 | Crystal, 21. 5 MC | 019-001960 |
| CR-6 | Crystal, 25 MC | 019-001961 |
| CR-7 | Crystal, 32. 5 MC | 019-201964 |
|  | Crystal, 30. 9 MC | 019-201962 |
|  | Crystal, 32. 0 MC | 019-201963 |
|  | Crystal, 33. 0 MC | 019-201965 |
|  | Crystal, 33. 5 MC | 019-201966 |
| CR-8 | Rectifier Diode | 019-101916 |

### MISCELLANEOUS

| Schematic Symbol | Description | Hallicrafters Part Number |
|---|---|---|
|  | Ball Bearing (Gear Drive) | 077-100505 |
|  | Ball Bearing (Gear Drive) | 077-101099 |
|  | Ball Race (Gear Drive) | 077-201020 |
|  | Box, Tank Coil | 066-301458 |
|  | Bracket, Mtg. Relay | 067-205146 |
|  | Bracket, Mtg. Crystal Filter | 067-204347 |
|  | Bracket, Control Mtg. Int. | 067-104355 |
|  | Bracket, Motor Mtg. | 067-204182 |
|  | Bracket, Control Mtg. Ext. | 067-104204 |
|  | Bracket, Meter Mtg. R. H. | 067-204340 |
|  | Bracket, Meter Mtg. L. H. | 067-204341 |
|  | Bracket, Motor Support | 067-304345 |
|  | Bracket, Mtg. Trimmer & Coil | 067-203456 |
|  | Bracket, Mtg. Coil Assembly | 067-103458 |
|  | Bracket, Gear Drive & Shield Mtg. | 067-103459 |
|  | Bracket, Trimmer Mtg. | 067-103922 |
|  | Bracket, Gear Drive Mtg. | 067-103011 |
|  | Bracket, Gear Adj. | 067-103042 |
|  | Bracket & Shaft Assembly (Idler Gear) | 067-203113 |
|  | Bracket Mtg. (Stop Arm) | 067-203162 |
|  | Bracket, PA Tuning mtg. | 067-204342 |
|  | Bracket (Unit Mounting) (Driver Assembly) | 067-204343 |
|  | Bushing & Cam Assembly (Gear Drive) | 077-200951 |
|  | Bushing, Dial (Gear Drive) | 077-201038 |
|  | Bushing, Friction Brake (Gear Drive) | 077-101037 |
|  | Cabinet, Foot | 016-100029 |
|  | Cabinet Bottom | 066-401494 |
|  | Channel, Rubber | 016-200929 |

### MISCELLANEOUS (CONT.)

| Schematic Symbol | Description | Hallicrafters Part Number |
|---|---|---|
|  | Connector | 010-100961 |
|  | Coupler, Solid | 029-100264 |
|  | Cover, Sideband Gen. | 066-401408 |
|  | Cover, Cabinet Top | 066-101451 |
|  | Cover, Final Amp. | 066-401456 |
|  | Cover, Box | 066-201457 |
|  | Cover, Transformer | 066-301459 |
|  | Cover, Relay | 066-201460 |
|  | Crescent Ring (Gear Drive) | 076-100725 |
|  | Dial, Scale, Main Tuning (Gear Drive) | 083-500568 |
|  | Escutcheon, Front Panel | 007-500659 |
|  | Fan Blade | 080-300305 |
|  | Flywheel | 071-100205 |
|  | Gear, Pinion Assembly | 041-250012 |
|  | Gear, Idler Assembly | 026-200283 |
|  | Glass, Dial (MT) | 022-200540 |
|  | Grommet (Motor Mounting) | 016-100034 |
|  | Holder, Fuse | 006-100451 |
|  | Insulator, Feed-Thru | 008-101015 |
|  | Insulator | 008-103696 |
|  | Insulator (Insert) | 008-103697 |
|  | Insulator (Insert) | 008-103722 |
|  | Insulator, (Feed-Thru) | 008-101014 |
|  | Instruction Book | 094-901652-B |
|  | Lever, Brake (Friction Brake) | 074-200999 |
|  | Line Cord & Plug (Motor) | 087-204833 |
|  | Line Cord Lock | 076-200756-01 |
|  | Line Cord Lock | 076-200756-02 |
| M-1 | Meter, Output Level | 082-400326 |
|  | Motor | 020-200088 |
|  | Pad (Clutch) (Gear Drive) | 008-102866 |
|  | Panel, Front | 068-400515 |
|  | Plate, Condenser Mounting | 063-100027 |
|  | Plate, Foot Reinforcing | 063-100334 |
|  | Pointer, Dial Scale | 082-200320 |
|  | Post, Latch | 011-100226 |
| RY-1 | Relay (Voice Control) | 021-000197 |
|  | Ring, Grip (Gear Drive) | 076-001135 |
|  | Ring, Retaining (Gear Drive) | 076-100775 |
|  | Ring, Self-Locking (Gear Drive) | 076-001100 |
|  | Shaft, Friction Brake | 074-201282 |
|  | Shaft, PA tuning | 074-201283 |
|  | Shaft, Driver tuning | 074-201284 |
|  | Shaft, Band Selector | 074-201285 |
|  | Shield, VFO | 069-301032 |
|  | Shield, Tube (12BY7) | 069-000863 |
|  | Shield, Tube (6AL5) | 069-100277 |
|  | Shield, Tube (7-Pin Tubes except V-16) | 069-100097 |
|  | Shield, Tube (9-Pin Tubes except V-10) | 069-200855 |
|  | Shield, Oscillator Socket | 069-100834 |
|  | Spacer (Driver Unit Mounting) | 073-000724 |
|  | Spacer Stop Arm (Gear Drive) | 073-101208 |
|  | Spring, Compression Idler (Gear) | 075-100376 |
|  | Spring, Final Amp. Cover | 075-200417 |
|  | Spring (Gear Drive) | 075-100345 |
|  | Spring, Torsion, (Stop Arm) | 075-100381 |
|  | Stop Arm & Pin (Gear Drive) | 076-201418 |
|  | Stud, Gear Bracket (Gear Drive) | 003-203500 |
|  | Stud, Shoulder (Gear Drive) | 073-201127 |
|  | Stud, Shoulder (Stop Arm) (Gear Drive) | 073-201123 |


4.95MC OSC. (CARRIER) V1A ($\frac{1}{2}$)12AU7
BRIDGED-T MODULATOR NETWORK
FILTER SECTION
4.95MC AMP V2 6AH6
FILTER SECTION
SIDEBAND SWITCHING OSCILLATORS V4 12AT7
4.05MC OR 13.95MC
MIXER 1 V3 6AH6
9MC AMP V5 6AU6
HETERODYNE XTAL OSC V6 6BA4
MIXER 2 V7 6AH6
MIXER 3 V8 6AH6
5.0-5.5MC
VFO V9 6CB6
DRIVER AMP V10 12BY7
POWER AMP V11 AND V12 2-6146
PI SECTION 50 OHM OUTPUT
SWITCH IN SIDEBAND POSITION
DIODE MODULATOR V14 12AU7
AUDIO INPUT 4MV SENSITIVITY
SPEECH AMP V13 12AX7
SPEECH AMP V1B ($\frac{1}{2}$) 12AU7
VOICE CONTROL AMPLIFIER V15B ($\frac{1}{2}$)12AX7
VOICE CONTROL DIODE V16A 6AL5
RELAY TUBE V17B ($\frac{1}{2}$)12AT7
VOX RELAY RY1
ANTI-TRIP DIODE V16B ($\frac{1}{2}$)6AL5
SAMPLE OF RECEIVER OUPUT
ANTI-TRIP AMP V15A ($\frac{1}{2}$)12AX7
ANTI-TRIP AMP V17A ($\frac{1}{2}$)12AT7
+750 VOLTS
H.V. RECTIFIER V18 5R4-GY
+350 VOLTS
L.V. RECTIFIER V19 5V4
-100 VOLTS
BIAS RECTIFIER SELENIUM SR1
+150 VOLTS
VOLTAGE REGULATOR V20 OA2

SIDEBAND SW OSC OUTPUT

| BAND | FREQUENCY (FOR UPPER SB) |
|---|---|
| 80M | 4.05MC |
| 40M | 13.95MC |
| 20M | 4.05MC |
| 15M | 13.95MC |
| 11M | 13.95MC |
| 10M | 13.95MC |

NOTE:
ON LOWER SIDEBAND
THE OTHER OSCILLATOR
IS USED

HET OSC OUTPUT

| BAND | FREQUENCY |
|---|---|
| 80M | INOPERATIVE |
| 40M | 21.5MCS |
| 20M | INOPERATIVE |
| 15M | 25.0MC |
| 11M | 30.9MC |
| 10M 28.0-28.5MC | 32.0MC |
| 28.5-29.0MC | 32.5MC |
| 29.0-29.5MC | 33.0MC |
| 29.5-30.0MC | 33.5MC |

MIXER 2 OUTPUT

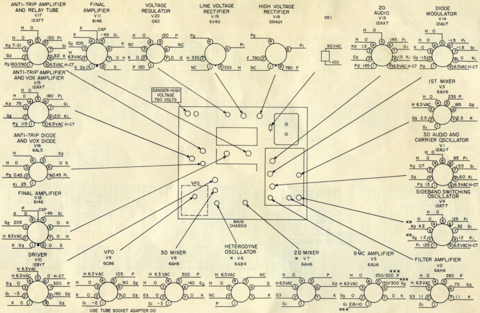
| BAND | FREQUENCY |
|---|---|
| 80M | 9.0MC |
| 40M | 12.5MC |
| 20M | 9.0MC |
| 15M | 16.0MC |
| 11M | 21.9MC |
| 10M | 23.0-24.5MC |

MIXER 3 OUTPUT

| BAND | FREQUENCY |
|---|---|
| 80M | 3.5-4.0MC |
| 40M | 7.0-7.5MC |
| 20M | 14.0-14.5MC |
| 15M | 21.0-21.5MC |
| 11M | 26.9-27.4MC |
| 10M | 28.0-30-0MC |

092-405160-B

Figure 10. Block Diagram


ANTI-TRIP AMPLIFIER AND RELAY TUBE V17 12AT7
H O
130 P1
K2 7-21
G1
3.0 K
G2
P2 180/290
6.3VAC H-CT
FINAL AMPLIFIER V11 6146
P CAP -49 G1
K
G2 205
H 6.3VAC
O H
K G3 O
S
VOLTAGE REGULATOR V20 0A2
K O
150 P
NC
NC
K O
O K
P 150
LINE VOLTAGE RECTIFIER V19 5V4G
P2
P1
H 335
NC
335 H
HIGH VOLTAGE RECTIFIER V18 5R4GY
P2
P1
F 780
NC
780 F
SR1
90VAC
-100
2D AUDIO V13 12AX7
H O
145 P1
K2 1.5
G1
G2
1.5 K1
P2 145
6.3VAC H-CT
DIODE MODULATOR V14 12AU7
H O
-1.5 P1
K O
-1.5 G1
G2 -1.5
O K1
P2
6.3VAC H-CT
ANTI-TRIP AMPLIFIER AND VOX AMPLIFIER V15 12AX7
H O
180 P1
K2 .75
G1
G2
2.0 K1
P2 115
6.3VAC H-CT
ANTI-TRIP DIODE AND VOX DIODE V16 6AL5
H
K2
H O
O S
P2 0.45
0.45 P1
K1 .25
FINAL AMPLIFIER V12 6146
P CAP -49 G1
K
G2 205
O K
H 6.3VAC
O H
K G3
O S
DRIVER V10 12BY7
H 6.3VAC
O H-CT
G3 O
300 P
G1 -3
190 G2
K O
G3
VFO V9 6CB6
H 6.3VAC
105 P
H O
90 G2
K O
O G3
G1 -2
3D MIXER V8 6AH6
H 6.3 VAC
300 P
H O
140 G2
G3 O
O K
G1 -3
HETERODYNE OSCILLATOR * V6 6AB4
H 6.3VAC
NC
H O
G
NC
K
P
2D MIXER * V7 6AH6
H O
P
H 6.3VAC
G2
G3
K
G1
9 MC AMPLIFIER V5 6AU6
H O
250/300 P ***
H 6.3VAC
150/300 G2 ***
K G3 O
O K
G1 2.8/-10 ***
FILTER AMPLIFIER V2 6AH6
H O
280 P
H 6.3VAC
75 G2
G3 1.1
1.1 K
G1
1ST MIXER V3 6AH6
H O
235 P
H 6.3VAC
185 G2
G3 2.5
2.5 K
G1
3D AUDIO AND CARRIER OSCILLATOR V1 12AU7
H O
95 P1
K2 0.7
-5.5 G1
G2
6.0 K1
P2 13
6.3VAC H-CT
SIDEBAND SWITCHING OSCILLATOR V4 12AT7
H O
125 P1
** K2 4.2
32 G1
** G2 1.2
1.2 K1
P1 125
6.3VAC H-CT
DANGER-HIGH VOLTAGE 760 VOLTS
VFO
MAIN CHASSIS

USE TUBE SOCKET ADAPTER. DO NOT REMOVE VFO COIL SHIELD

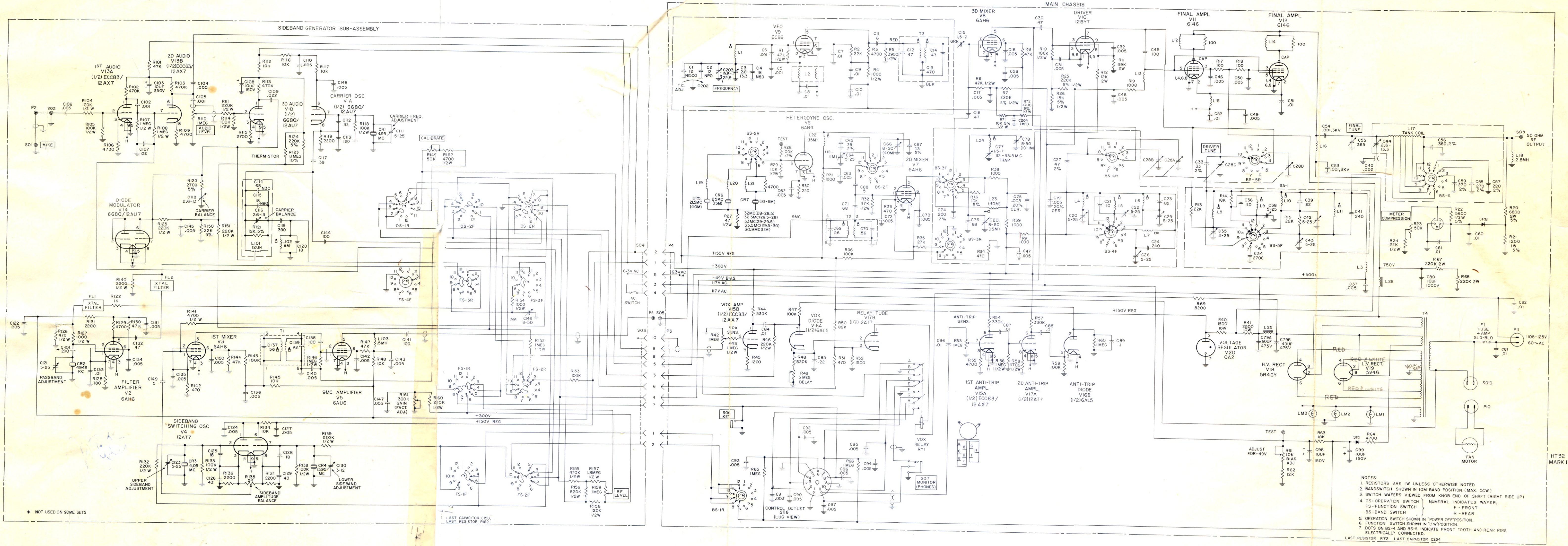
NOTES:

1. BASING DESIGNATION; BOTTOM VIEW OF TUBE SOCKETS.
2. * SOCKET VOLTAGES VS, BAND SWITCH SETTING. (SEE CHART)
3. ** CHART VOLTAGES SHOWN ARE FOR UPPER SIDEBAND POSITION ON 80 METERS-NO MODULATION.
4. *** VOLTAGE CHANGE ACCORDING TO WHERE FACTORY GAIN IS SET.
5. FOR CONVENIENCE ON SIDEBAND GENERATOR UNIT USE TUBE SOCKET ADAPTER FOR VOLTAGE CHECKS.

| TUBE | PIN | 80M | 40M | 20M | 15M | 10M |
|---|---|---|---|---|---|---|
| 6AB4 HETERODYNE OSCILLATOR | PLATE | 145V | 145V | 145V | 145V | 145V |
| | CATHODE | 1.2V | 1.35V | 1.2V | 1.2V | 1.2V |
| | GRID | 0V | -2.7V | 0V | -1.5V | -1.5V |
| 6AH6 HETERODYNE MIXER (NO SIGNAL FROM SIDEBAND GENERATOR) | PLATE | 310V | 310V | 280V | 310V | 310V |
| | SCREEN | 115V | 30V | 100V | 115V | 110V |
| | CATHODE | 2.1V | .7V | 1.5V | 2.2V | 2.3V |

92-5161

Figure 11. Voltage Chart


SIDEBAND GENERATOR SUB-ASSEMBLY
MAIN CHASSIS
1ST AUDIO V13A (1/2) ECC83/ 12AX7
2D AUDIO V13B (1/2)ECC83/ 12AX7
3D AUDIO V1B (1/2) 6680/ 12AU7
CARRIER OSC V1A (1/2) 6680/ 12AU7
CARRIER FREQ. ADJUSTMENT
AUDIO LEVEL
THERMISTOR
CALIBRATE
DIODE MODULATOR V14 6680/12AU7
CARRIER BALANCE
XTAL FILTER
FILTER AMPLIFIER V2 6AH6
PASSBAND ADJUSTMENT
1ST MIXER V3 6AH6
9MC AMPLIFIER V5 6AU6
GAIN (FACT. ADJ)
SIDEBAND SWITCHING OSC V4 12AT7
UPPER SIDEBAND ADJUSTMENT
SIDEBAND AMPLITUDE BALANCE
LOWER SIDEBAND ADJUSTMENT
RF LEVEL
MIKE
* NOT USED ON SOME SETS
LAST CAPACITOR C150 LAST RESISTOR R162
VFO V9 6CB6
FREQUENCY
T.C. ADJ
HETERODYNE OSC. V6 6AB4
2D MIXER V7 6AH6
3D MIXER V8 6AH6
DRIVER V10 12BY7
FINAL AMPL V11 6146
FINAL AMPL V12 6146
DRIVER TUNE
FINAL TUNE
L17 TANK COIL
50 OHM RF OUTPUT
METER COMPRESSION
VOX AMP V15B (1/2) ECC83/ 12AX7
VOX SENS
VOX DIODE V16A (1/2)6AL5
RELAY TUBE V17B (1/2)12AT7
DELAY
ANTI-TRIP SENS.
1ST ANTI-TRIP AMPL. V15A (1/2) ECC83/ 12AX7
2D ANTI-TRIP AMPL. V17A (1/2)12AT7
ANTI-TRIP DIODE V16B (1/2)6AL5
VOX RELAY RY1
CONTROL OUTLET SO8 (LUG VIEW)
SO7 MONITOR (PHONES)
AC SWITCH
VOLTAGE REGULATOR V20 OA2
H.V. RECT V18 5R4GY
L.V. RECT. V19 5V4G
FUSE 4 AMP SLO-BLO
105-125V 60~AC
FAN MOTOR
ADJUST FOR-49V
BIAS ADJ
+150V REG
+300V
-49V BIAS
117V AC
6.3V AC
HT32 MARK I
089-600749-F

NOTES:
1. RESISTORS ARE 1W UNLESS OTHERWISE NOTED
2. BANDSWITCH SHOWN IN 10M BAND POSITION. (MAX. CCW.)
3. SWITCH WAFERS VIEWED FROM KNOB END OF SHAFT (RIGHT SIDE UP)
4. OS-OPERATION SWITCH, FS-FUNCTION SWITCH, BS-BAND SWITCH } NUMERAL INDICATES WAFER, F - FRONT, R - REAR
5. OPERATION SWITCH SHOWN IN "POWER OFF" POSITION.
6. FUNCTION SWITCH SHOWN IN "C W" POSITION.
7. DOTS ON BS-4 AND BS-5 INDICATE FRONT TOOTH AND REAR RING ELECTRICALLY CONNECTED.

LAST RESISTOR R72 LAST CAPACITOR C204

Figure 12.

# Warranty

"The Hallicrafter's Company warrants each new radio product manufactured by it to be free from defective material and workmanship and agrees to remedy any such defect or to furnish a new part in exchange for any part of any unit of its manufacture which under normal installation, use and service discloses such defect, provided the unit is delivered by the owner to our authorized radio dealer, wholesaler, from whom purchased, or, authorized service center, intact, for examination, with all transportation charges prepaid within ninety days from the date of sale to original purchaser and provided that such examination discloses in our judgment that it is thus defective.

This warranty does not extend to any of our radio products which have been subjected to misuse, neglect, accident, incorrect wiring not our own, improper installation, or to use in violation of instructions furnished by us, nor extend to units which have been repaired or altered outside of our factory or authorized service center, nor to cases where the serial number thereof has been removed, defaced or changed, nor to accessories used therewith not of our own manufacture.

Any part of a unit approved for remedy or exchange hereunder will be remedied or exchanged by the authorized radio dealer or wholesaler without charge to the owner.

This warranty is in lieu of all other warranties expressed or implied and no representative or person is authorized to assume for us any other liability in connection with the sale of our radio products."

Form No. 94X622

**the Hallicrafters co.**